This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

RAND & WARING

Drill and Compressor Co.

21 PARK ROW,

OPPOSITE NEW POST OFFICE,

NEW YORK.

MANUFACTURERS OF

RAND & WARING'S

AIR COMPRESSOR

FOR DRIVING

ROCK DRILLS, PUMPS,

Hoisting and Other Machinery.

IN MINES, TUNNELS, &c.

CONSTRUCTED WITH MOST RECENT PATENTED IMPROVEMENTS.

MANUFACTURERS OF

STEAM ROCK DRILLS.

☞ SEND FOR DESCRIPTIVE PAMPHLET.

Hosted by Google

"ECLIPSE"
LUBRICATING OIL CO.

OF THE CITY OF

FRANKLIN, PA.

(INCORPORATED BY THE STATE OF PENNSYLVANIA.)

ALBERT G. EGBERT, Pres't.
WM. M. N. HAYS, Treas.
H. W. C. TWEDDLE, Gen. Manager.
CHAS. W. MACKEY, Vice-Pres.
W. N. HOWARD, Secretary.
EDW'D SCHMIDT, Gen. Agent.

RAILWAY LUBRICATING OILS.

Supply of Railways and Steamships

A SPECIALTY.

"ECLIPSE" R. R. AXLE OIL,
Stands low temperature without congealing
" **EXTRA COACH OIL,**
For Sleeping Coaches and Express Cars.
" **EXTRA ENGINE OIL.**
" **POLARINE ENGINE OIL.**
" **NEUTRAL TOPAZ OIL,** } For Compounders.
" **LADRONE OIL** }

"ECLIPSE" MINERAL COLZA OIL,

438° fire test—the safest Illuminating Oil in the Market for Railways, Steamships and Light Houses—328° higher test than ordinary refined Petroleum.

Works at Aladdin, Armstrong Co., Pa., and at Franklin, Pa.

Offices at Franklin, Pa., and 2 Liberty St., N.Y.

Agents: MAXWELL, WHEELER & CO., - 393 Illinois Street, CHICAGO.
" E. MAXWELL, - - - 719 N. Main Street, ST. LOUIS.
" C. TIERS MEYERS, - - 41 & 43 Front St., PHILADELPHIA.

Address "ECLIPSE" LUBRIC OIL CO.
P. O. BOX 3920, N. Y.

Hosted by Google

BUYERS' GUIDE

AND

MECHANICS' MANUAL,

FOR THE USE OF

RAILWAY OFFICIALS,

CONTAINING A COMPLETE LIST OF ALL ARTICLES WANTED BY

RAILWAY COMPANIES,

WITH THE NAMES OF

EXCLUSIVE FIRST HANDS,

AMONG

Manufacturers, Importers and Commission Merchants

IN EVERY LINE; ALSO, A NUMBER OF

VALUABLE TABLES AND RECIPES.

Published by E. W. BULLINGER, 75 Fulton St., N. Y.

New York.

J. W. PRATT, PRINTER, 75 FULTON STREET.

1873.

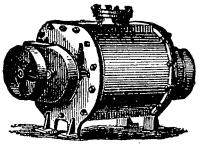
Hosted by Google

S. S. TOWNSEND,

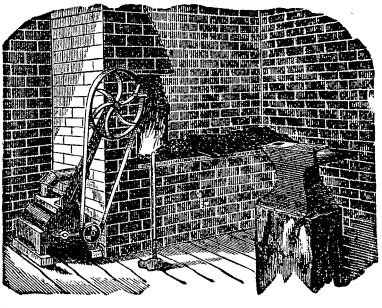
31 Liberty Street, - - New York,

GENERAL AGENT FOR

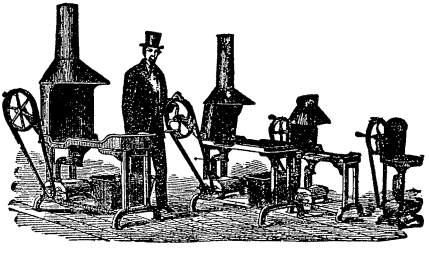
P. H. & F. M. ROOT'S



PATENT FORCE BLAST ROTRY BLOWERS.



BLACKSMITHS' HAND BLOWERS,



AND

IMPROVED PORTABLE FORGES.

Address, for Circulars and Price List,

S. S. TOWNSEND,

31 LIBERTY STREET, NEW YORK.

Hosted by Google

INDEX TO BUSINESS DIRECTORY.

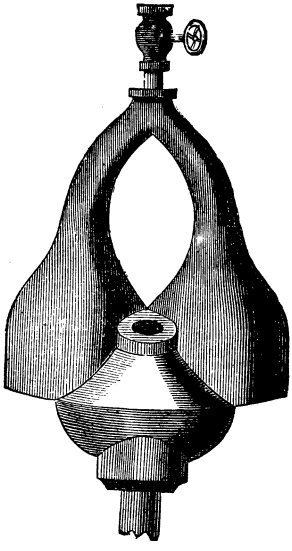
For Index to Tables, Recipes, &c., see pages 15, 17, and 19.

See Notices at Foot of Page 13.

	PAGE.
Adzes	21
Air Brakes	21
Air Compressors	21
Air Pumps	21
Angle Iron	21
Annunciators	21
Anti-Explosives	21
Anti-Friction Agents	21
" " Bearings	21
" " Metal	23
" " Slide Valve	23
Antimony	23
Anti-Vacuum Valve	23
Anvil Blocks	23
Anvils	23
Artesian Well Tubing	23
Asbestos	23
" Boiler Felting	25
" Roofing	25
Asphaltum	25
Assayers	25
Augur Ratches	25
Automatic Gear Cutting Machines	25
Axe Manufacturers	25
Axle Grease	25
" Lathes	27
Axles	27
Babbitt Metal	27
Badges	29
Baggage Barrows	29
" Checks	29
Baker's Tile	29
Ball Pene Hammers	29
Band Saws	29
Band Sawing Machines	29
Bar Iron	125
Bark Mills	29
Bar Lead	29
Bars	29
Batteries, Telegraph	31
Bellows	31
Bells	31
Belt Dogs	31
Belting	31
Bench Screws	31
Bending Rolls	33
Bismuth	33
Black Lead	33
Blacksmith's Tools	33
Blank Books	33
Blaster's Tools	33
Blast Furnaces	33
" Furnace Blocks	33
Blasting and Mining Wires	33
Blind and Sash Makers	33
Blocks	33
Block Tin	33
Blowers	33
Boiler Covering	35
" Felting	35
" Iron	35
" Makers	35
" Makers' Tools	35
" Plate and Drilling Machines	35
" Plates	35
" Powders	35
" Ratchets	35
" Rivets	39
Boilers	39
Boiler Scale Preventive	39
" Tubes and Flues	39
Bolt Cutters	41
" Ends	41
" Heading Machines	41
Bolts	41
Bolt Screwing Machines	41
Boring Bars	41
" Implements	41
" Machines	43
Brakes	43
Brands—Burning	43
Brass	43
" Castings	43
" Cocks and Valves	43
" Ingot	43
" Fittings	43
" Founders and Finishers	45
" Padlocks	45
" Tubing	45
" Wire	45
Brick	45
Bridge and Roof Bolts	45
" Builders	45
" Castings	45
" Irons	45
Bridges	45
Brokers	45
Bronze Castings	47
" Door Knobs	47
" Door Trimmings	47
Brushes for Tubes	47
Builders' Hardware	47
Building Materials	47

Hosted by Google

THE PULSOMETER



OR

MAGIC PUMP!

A NEW ERA IN

Steam Hydro-Engineering,

FLUIDS MOVED BY SELF-ACTING PULSATIONS,

Steam Pumps Supplanted,

Piston Rods, Cylinders,

Packing, Stuffing Boxes

and Air Chambers of

no Further Use.

The Experience of Ages Set at Naught,

AND PHILOSOPHY CONFOUNDED.

This Apparatus is of vast importance and incalculable value to the Railroad, Steamboat, Mining and Manufacturing Community, and all others directly or indirectly interested in the use of Steam.

It consists only of a single piece of unfinished casting, cylindrical in form, standing upon one end, and is so constructed internally, that when properly connected with the necessary Steam and Water Pipes, it performs all the wonderful functions of the Steam Pump; raising and forcing a constant stream of water at the same time.

It will raise water to the height due a perfect vacuum, and then force the same to a height due the initial pressure of Steam in the Boiler operating it.

Having no moving parts it can never wear out, consequently all the vexatious repairs incident to Steam Pump Engineering is obviated. It will Pump Gritty or Muddy Water, or even Mud of the consistency of mortar, without injury to its parts in the least. Hence, its value for Mining and similar situations.

It is perpetual in its operation, and can never cease its pulsations as long as the conditions of its action are maintained.

When adjusted on a Locomotive or Steam Boiler, it not only takes the place of the Feed Pump, but automatically keeps the Water within the Boiler at any desired elevation, operating with absolute certainty, and delivering the water in a constant stream just as needed; thus obviating the primary cause of Boiler Explosions.

It can be successfully used in any position and for any purpose within the scope of the Steam Pump, as well as in many situations where a Pump would be practically useless.

SEND FOR CIRCULAR.

C. HENRY HALL & CO.

No. 20 Cortlandt St., New York.

Hosted by Google

PAGE.
Bunting..... 47
Burglar Alarms..... 47
Butts..... 47
Buyers of Old Metal..... 49

Cabinet Makers' Machinery..... 49
Cabinet Woods..... 49
Cable Chain..... 49
Cables—Telegraph..... 49
Callipers..... 49
Canal Bridges..... 49
Candles..... 51
Cap Screws..... 51
Car Axles..... 51
Car and Journal Bearings..... 53
" Bits..... 53
" Boxes..... 53
" Box Borers..... 53
" Brasses..... 53
" Builders..... 53
" Colors..... 53
" Door Catches..... 55
" Door Locks..... 55
" Equipments..... 55
" Glass..... 55
" Hassocks..... 57
" Hooks..... 57
" Irons..... 57
" Linings..... 57
" Makers' Machinery..... 57
" Packing..... 57
" Plushes, &c..... 59
Carpenters' Tools..... 59
Carriage Builders' Machinery..... 59
" Bolts..... 59
" Hardware..... 59
Cars..... 61
" Springs..... 61
" Stoves..... 61
" Trimmings..... 61
" Varnishes..... 61
" Wheel Borers..... 61
" Wheels..... 263
Castings..... 63
Cast Iron Sinks..... 63
" Steel..... 65
Cement..... 65
Chain Links..... 65
Chains..... 65
" Measuring..... 65
Chasing Lathes..... 65
Chemicals—Telegraph..... 67
Chilled Faced R. R. Frogs..... 67
Chimes..... 67
Chisels..... 67
Chucks..... 67
Church and School Bells..... 67
Chute Nails..... 67
Circular Saw Mills..... 67
" Saws..... 67
Clamps..... 69
Claw and Tamping Bars..... 69
Clocks..... 69
Coach Colors..... 69
" Oil..... 69
" Screws..... 69
" Varnish..... 69
Coal..... 69
" Facing..... 71
" Hods and Vases..... 71
" Miners' Supplies..... 71

PAGE.
Coal Washing Machinery..... 71
Coiled Chain..... 71
" Springs..... 71
Coking Machinery..... 71
Cold Rolled Piston Rods..... 71
" " Shafting..... 181
Colors, Dry..... 71
" for Freight and Coal Cars..... 73
" in Oil..... 73
Commission Merchants..... 73
Compasses..... 73
Composition Castings..... 73
Condensors..... 73
Conductors Punches..... 73
Contractors..... 73
" Machinery..... 73
" Supplies..... 75
" Tools..... 75
Copper..... 75
" Bottoms..... 75
" Ingot..... 75
" Locomotive Sheets..... 75
" Nails..... 75
" Rivets and Burs..... 75
" Tubing..... 75
" Wire..... 77
" " Insulated..... 77
Copying Presses..... 77
Cordage..... 77
Corrugated Iron..... 77
Cotton Drills..... 77
Cotton Waste..... 77
Couplings..... 77
" Patent..... 181
Covered Wires..... 77
Cranes..... 79
Crestings..... 79
Crossings..... 79
Crow Bars..... 79
Crucibles..... 79
Crude Gutta Percha..... 79
Cupola Linings..... 79
Cupolas..... 81
Cutlery..... 81
Cutting Nippers..... 81
Cylinders..... 81
" Boring and Facing Machines..... 81

Dating Machines..... 81
Depot Scales..... 81
Derricks..... 81
Desks..... 83
Dies..... 83
Door Knobs..... 83
" Machinery..... 83
Drawing Room Car Hassocks..... 83
Drill Grinding Machines..... 83
Drills..... 85
Drilling Machines..... 87
Drill Presses..... 87
Driving Wheel Lathes..... 87
Drop Presses..... 87
Dryers..... 87

Edge Tools..... 87
Electrical Engineers..... 87
Electric Alarms..... 87
" Apparatus for Mining..... 89
" Bells..... 89
" Instruments..... 89

Hosted by Google

BOYNTON'S PATENT

LIGHTNING SAWS!

Also, manufacturer of all kinds of first-class Saws and Saw Handles.

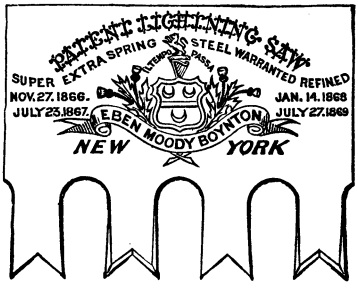
The inventor of this Saw claims that its superiority over all others is now established beyond dispute. No other manufacturer has yet ventured to put his Saws in competition with it at the AMERICAN INSTITUTE or elsewhere, and the challenge of $500 for a public trial has never been accepted. It is needless, therefore, to speak of the merits or defects of the various Saws now on the market. The intelligent workman will select the tool that will do the most work with the least labor, and which, at the same time possesses the requisite strength and simplicity of construction, in which respects this Saw has proved itself far ahead of all others, as will be seen by the Testimonials, which will be mailed to applicants.

Awarded Medal of American Institute, over all competitors, Nov. 1872.

These Saws have also been highly spoken of in the following well known papers, copies of which can be seen at the office of the inventor, viz: "Scientific American," "American Artizan," "New York Tribune," "New York World," "Christian Union," "Christian Radical," "Examiner and Chronicle." "American Agriculturist," "Hearth and Home," "Iron Age," "Liberal Christian," "Baptist Union," "Kansas Tribune," "Davenport (Iowa) Gazette," "Davenport Democrat," "Moore's Rural New Yorker," "New York Evangelist," "New York Observer," "Independent," "The Western Rural," "Chicago Standard," and many others.

BOYNTON'S CROSS-CUT SAWS

In quality of material are fully equal to any in the market, and each blade is subjected to a rigid inspection before leaving the factory. They are made from 4 to 10 feet in length.



CAUTION.

As these Saws have been largely imitated, (but all omitting some essential principal,) purchasers should be very careful to buy none but those having the name and trade mark of E. M. Boynton, with the $500 challange and directions for filing, using, &c., etched on them.

BOYNTON'S ONE-MAN CROSS-CUT SAW

Will be found very suitable for *Carpenters, Bridge Builders,* and all who work heavy timber. It is, also, well adapted to *Farmer's* use for sawing down trees, cutting up cord-wood, fence posts, and small logs. It can be used by two men whenever necessary, by attaching one of Boynton's Patent Handles, which are removable at pleasure. It will do as much work as four good choppers.

E. M. BOYNTON, Sole Proprietor and Manufacturer,

80 Beekman Street, New York.

Hosted by Google

PAGE.
Electric Machinery..... 89
" Signals..... 91
" Supplies..... 91
Elevators..... 91
Emery..... 91
" Belts..... 91
" Grinders..... 91
" Wheels..... 93
Engine Builders, Steam..... 93
" Lathes..... 93
" Trimmings..... 93
Engineers..... 93
" Instruments..... 93
" Stationery Materials..... 93
Engines..... 93
Engravers..... 93
Exhaust Nozzles..... 95
Extra Irons..... 95

Factory Bells..... 95
Feather Brushes..... 95
Fellys..... 95
Felt..... 95
Felting..... 95
Files..... 95
Fire Brick..... 97
" Buckets..... 97
" Clay..... 97
" Engines..... 97
Fish Bars..... 97
" Plates..... 97
Flags..... 97
Flange Pipes..... 97
Flue Iron..... 99
Fog Signals..... 99
Foot Lathes..... 99
Force Pumps..... 99
Forge Bellows..... 99
Forges..... 99
Forgings..... 101
Founders..... 101
" Tools..... 101
Foundry Facings..... 101
" Fixtures..... 101
" Supplies..... 101
Freight Cars..... 101
Frogs..... 101
Frog Signals..... 103
Furnaces..... 103
Furniture..... 103
Fuses..... 103

Galvanized Iron..... 103
" Nails..... 103
" Pipe..... 105
Galvanizers..... 105
Galvanometers..... 105
Gas Apparatus..... 105
Gas and Steam Fittings..... 105
" " Fitters' Tools..... 107
Gas Pipe..... 107
Gauges..... 107
Gauge Tubes..... 107
Geared Foot Lathes..... 107
Girders..... 109
Glass Bearings..... 109
" Letters..... 109
" Looking..... 109
" Ornamented..... 109
" Plate..... 109
" Window..... 109

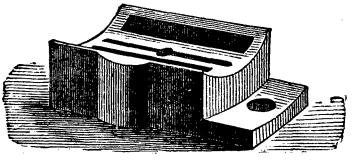
PAGE.
Glaziers' Points..... 109
Globe and Angle Valves..... 109
Gongs..... 109
Grindstones..... 109
Grindstone Boxes..... 113
Gun Powder..... 113
Gutta Percha..... 113
" " Pipe..... 113

Hammer Dies..... 113
Hammers..... 113
Hand Forcing Machines..... 115
" Lamps..... 115
" Lathes..... 115
" Punches..... 115
" Shears..... 115
" Stamps..... 115
Hangers..... 115
Hardware..... 115
Hard Wood Doors..... 115
Harness..... 115
Harrow Teeth..... 117
Hasps..... 117
Hassocks..... 117
Head Lamps and Lights..... 117
" Light Oil..... 117
" Linings..... 119
Heating Apparatus..... 119
Hinge Nails..... 119
Hinges..... 119
Hoes..... 119
Hoisting Grapple..... 119
" Machines..... 119
Hoop Iron..... 119
Hoppers..... 119
Horse Shoe Iron..... 119
" Shoes..... 121
" Shoers' Tools..... 121
Hose..... 121
" and Ladder Straps..... 121
" Couplings..... 121
" Jacket..... 121
" Pipes..... 121
Hotel Annunciators..... 121
Hydrants..... 123
Hydraulic Engines..... 123
" Jacks..... 123
" Machinery..... 123
" Pipe..... 123
" Presses..... 123
" Punches..... 123
" Valves..... 123
Hydrostatic Wheel Presses..... 123

Incrustation Powders..... 123
Iron..... 125
" Bar..... 125
" Buildings..... 125
" Burs..... 127
" Doors and Shutters..... 127
" Fittings..... 127
" Founders..... 127
" Merchant..... 167
" Merchants..... 127
" Ore Crushers..... 127
" Ores..... 131
" Padlocks..... 131
" Paints..... 131
" Pig..... 183
" Pipe..... 133
" Railroad..... 199

Hosted by Google

G. W. W. STEVENS & CO.



SOLE MANUFACTURERS OF THE

"STAR METAL,"

And all other RAILWAY JOURNAL BEARING, and General BRASS FOUNDERS and FINISHERS,

95 Liberty Street, New York City.

D. S. STEVENS, MANAGER.

Hosted by Google

PAGE.
Iron Rods 133
" Sheet 213
" Shutters and Doors 133
" Tubing 135
" Wire 135
" Working Machinery 137

Japans 137
Joints 137
Journal Bearings 139

Knife Grinders 139

Lace Leather 139
Ladles 139
Lag Screws 139
Lamp Posts 139
Lamps 141
Lanterns 141
Lard Oil 143
Lathe Centre Grinders 143
" Chucks 143
" Dogs 143
Lathes 143
Lead 143
" Pipe 145
Learners Telegraph Instruments 145
Leather Belting 147
" Hose 149
" of all kinds 149
Levels 151
Lightning Rods 151
Light Locomotives 151
Lime Kiln Blocks 151
Linen Hose 151
Linseed Cake 153
" Oil 153
Litharge 153
Lithography 153
Local and Coupon Tickets 153
Lock Nuts 155
Locks 155
Locomotive Balances 155
" Bells 155
" Blocks 155
" Builders 155
" Head Lights 155
Locomotives 157
Log Sawing Machines 157
Looking Glasses 157
Lubricating Oils 157
Lubricators 159
Lumber 159

Machine Bits 159
" Forgings 159
" or Nut Taps 159
Machines for Emery Wheels 161
Machine Bolts 159
Machine Oils 159
Machinery 161
Machine Screws 161
Machinists 161
" Supplies 161
" Tools 163
Malleable Iron Castings, &c. 163
Manufacturer's Agents 163
Marine Forgings 163
Marking Cards 163
Masons' Tools 163
Mathematical Instruments 163

PAGE.
Mattocks 163
Mauls 163
Measuring Tapes 165
" Chains 65
Mechanics' Tools 165
Medical Apparatus 165
Merchant Iron 167
Metal Blanks 167
" Cornices 167
Metallic Packing 167
" Paints 167
Metallurgists 167
Metals 167
Milling Machines 169
Mineral Door Knobs 169
Mining Engines 169
" Locomotives 169
" Machinery 169
" Tools 169
Models 169
Mortising Machines 169
Moulders' Tools 169
Moulding Cutters 169
Muck Bars 169

Nail Rods 171
Nails, Cut 171
" Wrought 171
Nickle 173
Nitro Glycerine 175
Nut Locks 175
Nuts 173
" Hot Pressed 175
" Hot and Cold Pressed 177
Nut Tappers 177

Oakum 177
Office Chairs 177
" Furniture 177
Oil Cabinets 177
" Cans and Cups 177
" of Vitriol 177
Oils 177
Oil Tank Car 177
" Well Casing 177
" " Tubing 177
Old Rails 177
Open Links 179
Orange Mineral 179
Ottomans 179

Padlocks 179
Paints 179
" for Railroads 181
Parallel Bench Vise 181
Passenger Cars 181
Patch Bolts 181
Paving Tools 181
Pens 181
Permanent Wood Filling 181
Picks 183
Pig Iron 183
" Lead 185
Pipe Tongs 185
Piston Rods 187
Pit Car Wheels 187
Pivot Bridges 187
Planes 187
Planing Machines 187
" Mills 187
Plated Knobs 189

Hosted by Google

ATWATER, WHEELER & CO.

New Haven, Conn.,

IRON MERCHANTS

AND

MANUFACTURERS,

Import through their LIVERPOOL HOUSE, or MANUFACTURE in their NEW HAVEN MILL, all grades of

Merchant Bar Iron,

Sheet Iron,

Scrap Iron,

Old Rails,

Cast Steel,

Spring Steel,

IRON WIRE,

BLACK OR GALVANIZED,

FOR FENCES AND TELEGRAPH LINES.

Hosted by Google

PAGE.
Plate Glass 189
Pliers 189
Plow Clevises 189
Plows 189
Plumbers' Castings 189
" Supplies 189
" Tools 189
Plush Buttons 189
Pop Valves 189
Porcelain Door Knobs 189
Portable Engines 191
" Forges 191
Powder 191
Power Machines 191
Presses, Copying 191
Printers 191
Pulleys 191
Pumps 193
Punches and Shears 193
Punching and Shearing Machines 193
Putty 193

Quarry Tools 195

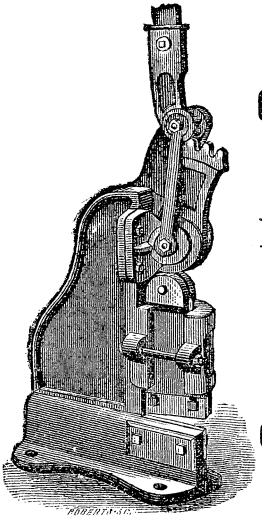
Railroad Baggage Checks 195
" Bonds, &c 195
" Car Forgings 195
" Castings 195
" Chairs 195
" Colors and Varnishes 197
" Engine Forgings 197
" Iron 199
" Machinery 199
" Spike Mauls 199
" Spikes 199
" Supplies 201
" Tools 201
" Tickets 201
" Track Scales 203
Rails 203
Railway Brakes 203
Ratchets 203
Reamers 203
Red Lead 203
Reflectors 203
Retorts 203
Riddles 203
Rivet Hammers 203
" Makers 203
Rivets 205
Riveting Machines 205
Rock Drills 205
Rods, Measuring 205
Rolling Mill Castings 205
" " Machinery 205
Roofing Materials 205
" Plates 205
" Slates 207
Ropes 207
Rubber Belting, Hose, &c 207
" Goods 207
" Springs 207

Safes 207
Safety Fuse 207
" Valves 207
Sand Paper 207
Sash and Blind Machinery 207
Sashes, Doors, &c 207
Sash Weights 209
Saw Gummers 209

PAGE.
Saw Frames 209
" Handles 209
" Makers 209
" Mill Machinery 209
" Mills 209
Saws 209
Scales 209
Scientific Books 209
Scrapers 209
Scrap Iron 209
Screw Bolts 209
" Plates 211
Screws 211
Seal Presses 211
Self-Feeding Hand and Power Drills 211
Set Screws 211
Shafting 211
Shaping Machines 211
Shears and Punches 213
Shearing Machines 213
Sheet Iron 213
" Lead 213
" Rubber 213
" Zinc 213
Shingles 213
" Strips 213
Ship Lanterns 213
Shovels 215
Signal Oil 215
Signals 215
Slate 215
" Roofing Tools 215
Sledges 215
Slide Lathes 215
Sliding Tables 215
Slothing Machines 215
Smelters 215
Smith's Tools 217
Smoke Stacks 217
Socket Pipes 217
Solder 217
Spades 217
Spark Arrester 217
Spelter 217
Sperm Oil 217
Spiegeleisen 219
Spike Mauls 219
Spikes 219
Splice Bars 221
Spoons 221
Springs 221
Spring Steel 221
Stamps 221
Staple Manufactures 221
Stationary Engines Forgings 221
Stationery 221
Steamboat Forgings 223
Steam Boilers 225
" Elevators 223
" Engines 223
" Fire Engines 225
" Gauges 225
" Hammers 227
" Packing 227
" Pipe 229
" Pipe Covering 229
" Pumps 227
Steamship Lines 229
" Supplies 229
Steam Warming Apparatus 229
" Whistles 229

Hosted by Google

BIDDLE MANUFACTURING CO.



102

Chambers

Street,

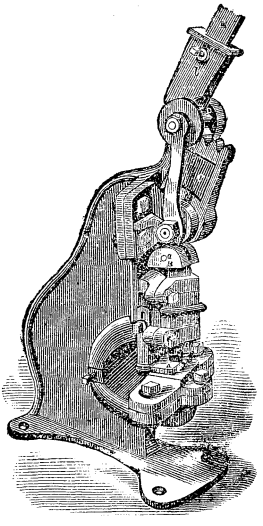
NEW YORK

WORKS

AT

Charlotteburg,

NEW JERSEY.



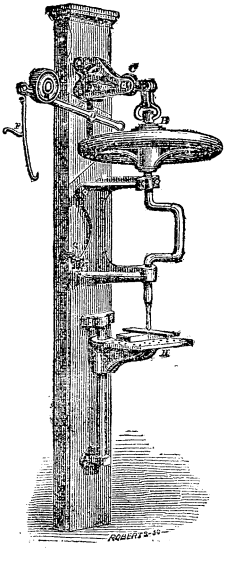
FINE

TOOLS

AND

Hardware

Specialties.



"Eureka" Patent Cutting Nippers.

Combination Wire Cutters and Plyers

Patent Self-Feed Hand Drills,

Hand Shears, Punches, &c.

WITH POWER ATTACHMENT, IF REQUIRED.

Hosted by Google

PAGE.
Steel 231
" Bells 231
" Car Springs 231
" Forgings 231
" Frogs 231
" Importers 233
" Manufacturers 233
" Rails 233
" Springs 233
" Tubes 233
" Tyres 235
Stencils 235
Stereotype Metal 235
Stone Masons' Tools 235
Stop Cocks 235
Stove Boards 235
" Linings 235
Straightening Machines 235
Street Cars 235
Submarine Telegraph Cables 235
Subterranean Telegraph Wires 237
Surveying Instruments 237
Switches 237
Switch Lights 237
" Locks 237
Syphons 237

Tacks, Brads, &c 237
Tallow 237
" Cans and Caps 239
" Lubricator 239
Tank Iron 239
Tanks 239
Tank Valves 239
Taps 239
Telegraph Apparatus 241
" Builders 241
" Material 241
" Poles 243
" Repairers' Tools 243
" Wires 243
Tiles 243
Timber 243
Tin and Coppersmiths' Solders 245
Tin, Pig 243
Tin, Plates 245
Tinsmiths' Tools 245
Tin Ware 245
T Iron 245
Tool Builders 245
Tool Handles 245
Tools 245
Track Bolts 245
" Layers' Tools 247
" Supplies 247
" Rails 247
Transits 247
Transfer Tables 247
Transportation Cans 247

PAGE.
Trucks 249
Tube Expanders 249
Tubing, Brass and Copper 249
Turn Buckles 249
Turning Machines 249
Turn Tables 249
Twist Drills 249
Twist Drill Grinders 251
Twisted Hooks 251
Type Metal 251
Tyres 251

Universal Drills 251
Urinals 251

Vacuum Gauges 251
" Pumps 253
Valve Oil 253
Valves 253
Vanes 253
Varnish 253
Ventilators 255
Vises 255

Washers 255
Washing Machines 257
Waste 257
Water Gauges 259
" Pipe 259
Wedges 259
Wheel Barrows 259
" Borers 261
" Presses 259
Wheels 263
Whistles, Steam 229
White Brass 265
" Lead 263
" Zinc 265
Window Glass 265
Wire 265
" Brushes 267
" Cloth 267
" Cutters 267
" Rope 267
Wood Mantels 267
" Mouldings 267
" Ornaments 267
" Screws 267
" Working Machinery 269
Woolen Waste 269
Wrecking Derricks 269
" Pumps 269
Wrenches 269
Wrought Iron Beams 271
" " Hardware 271
" " Pipe 271
" " Tubes 271

Zinc 271

The arrangement of the names of the various dealers, under the different heads in the Business Directory, was made by direction of the advertisers, and not at the discretion of the publisher.

Extra copies of this work will be furnished by the Publisher at $1.00 each; address, E. W. BULLINGER, 75 Fulton St., New York

Hosted by Google

INMAN LINE

STEAM TWICE A WEEK TO EUROPE.

TO LIVERPOOL, CALLING AT CORK, IRELAND.

FULL-POWERED, CLYDE-BUILT, IRON STEAMSHIPS,

UNDER CONTRACT FOR CARRYING THE BRITISH MAILS.

Steamships.	*Commanders.*	*Steamships.*	*Commanders*
City of Chester		**City of Baltimore**	Delamotte.
City of Richmond		**City of Washington**	G. Lochead.
City of Montreal	J. Kennedy.	**City of New York**	T. C. Jones.
City of Brussels	S. Brooks.	**City of Limerick**	W. Jamieson.
City of Brooklyn	H. Tibbits.	**City of Bristol**	Phillips.
City of Paris	R. Leitch.	**City of Halifax**	Hurd.
City of Antwerp	J. Eynon.	**City of Durham**	———
City of London	J. Mirehouse.		

☞ Sail from the Company's Wharf, PIER 45, NORTH RIVER, every *Saturday* and every *Thursday*.—See Daily Papers.

RATES OF PASSAGE.

FIRST CABIN, PAYABLE IN GOLD.

First Cabin	to Queenstown or Liverpool	$75	and $90
"	to London	80	" 95
"	to Hamburg, Antwerp and Rotterdam	85	" 100
"	to Paris	90	" 105

STEERAGE, PAYABLE IN CURRENCY.

Steerage	to Liverpool, Queenstown, Glasgow or Londonderry	$30
"	to London or Bristol, through by Rail	30
"	to Hamburg, Antwerp, Havre or Rotterdam	35
"	to Sweden, Norway, Denmark and Paris	38

Children between One and Twelve, Half Fare. Infants under One Year, Free.

FROM LIVERPOOL OR QUEENSTOWN—Leaving Liverpool every Tuesday and Thursday, and Queenstown (Cork Harbor), every Wednesday and Friday.

RATES OF PASSAGE TO NEW YORK OR BOSTON—First Cabin, Inside Rooms, $90; Outside Rooms, $105, Gold. Steerage, $32, Currency.

Children between One and Twelve, Half Fare. Infants under Twelve Months, in Steerage, $3.00 Currency. Tickets can be bought here at these rates, by persons wishing to bring out their friends.

☞ Drafts payable on presentation in England, Ireland and Scotland for £1 and upwards. Parcels $1 and upwards, according to size and value. ☜

JOHN G. DALE, Agent,

15 Broadway, New York.

Hosted by Google

INDEX TO TABLES, RECIPES, &c.

Publisher's Notice.—In selecting the information published herein, I have aimed to give only such tables, &c., as are of practical, every-day use; such as a mechanic will find occasion to refer to very frequently, and by their use, in conjunction with the Silicate Slates (on inside of the covers) and the Memorandum paper, an estimate can be made on almost any kind of an ordinary piece of work, and preserved for future reference.

As will be seen by the heads of the various tables, I have copied from different works published for the use of Mechanics, Engineers, &c., and I beg to advise all who may find the tables herein of value to them, that they buy one or more of these books—they will be found of almost incalculable service; we give below a list of them.

The Civil Engineers' Pocket Book,
by J. C. Trautwine.....Price $5.00, Tucks.

Engineers' and Mechanics' Pocket Book,
by C. H. Haswell.....Price $3.00, Tucks.

Mechanics', Machinists' and Engineers' Book of Reference,
by Charles Haslett.....Price $2.50, Tucks.

Useful Information for Railway Men,
by W. G. Hamilton.....Price $2.00.

Useful Formulæ and Memoranda,
by G. L. Molesworth.....Price $2.00.

I will forward any of the above on receipt of the money. Address,

E. W. BULLINGER, 75 Fulton St., New York.

PAGE.

Acres required for Roadway..... 53
Adhesive power of Locomotives..... 149
Alloys 63
" Specific Gravity. 93
American Wire Gauge..... 35
Angle Iron, Weight of.....145, 147
Anti-Explosives.....110, 111
Apothecaries Weight..... 185
Arches..... 181
Areas of Circles.....221 to 235
Artesian Tubes, heavy..... 57
" " light..... 59
Avoirdupois Weight..... 185

Band Iron, feet in bundle..... 109
Band Saws..... 209
Bar Brass, weight of..... 63
" Copper, " 117
" Iron, feet in bundle..... 107
" " Round, weight of..... 45
" " Square, " 43
" Lead..... 117
Beams and Channels, Iron..... 179
Belting, power, &c..... 261
" how to measure..... 265
" cement 209
Birmingham Wire Guage..... 35
Board Measure.....157 to 163
Boiler Flues, weight of..... 59
" " strength of..... 155

PAGE.

Boiler Iron, thickness, &c..... 31
" " weight, &c..... 31
" Shells, strength of..... 153
" Tubes, standard sizes..... 73
Bolts, Heads, &c., weight of..... 29
" for one mile of track..... 119
Brass Bar and Sheet, weight of..... 63
" Wire, weight of..... 51

Cables, Hempen, safe loads..... 113
Car Springs.....61, 201
Casing for Oil Wells..... 59
Cast Iron Pipe, weight of..... 27
" " hardening 77
Cement, for fire and water..... 57
" for stopping joints..... 57
" for leather belting..... 209
Chairs, per mile of track..... 121
Circles, properties of..... 197
" areas .....221 to 235
" circumferences.....221 to 235
" diameters.....221 to 235
Cisterns..... 57
Columns, iron.....49, 55
Copper, Bar, weight of..... 113
" Locomotive sheets..... 127
" Pipes, weight of..... 105
" Rods, " 75
" Wire, " 51
" Sheet, " 117, 123

Hosted by Google

J. G. KNAPP MANUFACTURING CO.,

MANUFACTURERS OF

SCHAEFFER & BUDENBERG, AND BOURDON

STEAM, VACUUM, HYDRAULIC and WATER

GAUGES.

Marine Clocks.

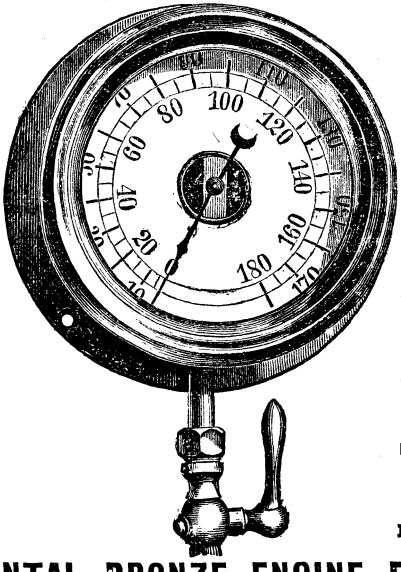
Engine Registers.

Hydraulic Test Pumps.

Gas Fitters' Test Pumps.

Cab Lights.

Gauge Clocks.



Oiler Sets.
Oval and Square.

Oil Filters.

Brass, Copper, Tin and Zinc Oilers.

Locom tive Oilers.

Tallow Cans

Brass and Copper Baskets,
For Cotton Waste.

ORNAMENTAL BRONZE ENGINE FRONTS,

CONTAINING

Steam and Vacuum Gauge, Counter, Clock and Thermometers,

ALL IN ONE CASE.

Myers' Patent Recording Gauge and Clock.

SOLE MANUFACTURERS IN U. S. OF THE

CELEBRATED GERMAN STUDENT'S LAMPS.

☞ Illustrated Circulars and Photographs sent on application ☜

Office, 26, 28 & 30 Frankfort Street, - NEW YORK.

Hosted by Google

PAGE.
Cross-Ties, to mile of track..... 121
Crowns of Arches..... 181
Cubes of Numbers.....237 to 271
Cube Root of Numbers .....237 to 271
Cubic Measure..... 191
Cubic Foot, equal to..... 191
Culverts 263
Cylinders, contents of..... 103

Diameter of Circles .....221 to 235
Driving Wheels, revolutions per mile.. 79
Drums, speed of..... 211
Dry Measure..... 193

English Railways.....137, 139

Falling Bodies, Velocity of..... 105
Fish Joints, per mile..... 263
Flange Pipes..... 49
Flat Iron, weight of.....65 to 71
" feet in bundle..... 107
Flat Ropes..... 83
Flues, strength of..... 155
Force of Wind..... 79
Foreign Money..... 199
French Measure, Cubic..... 191
" " Long..... 187
" " Square 189
" Weight 185

Galvanized Sheet Iron.. 91
Gas Pipes, weight of..... 59
Gearing Wheels.....167 to 173
Glass..... 127
Gradients, table of..... 151
Grindstones, weight of..... 211

Heat, effects of..... 115
Hempen Ropes and Cables..... 113
Hoop Iron, weight of..... 47

Iron, Band, feet in bundle..... 109
" Bar, Square, weight of..... 43
" " " feet in bundle..... 107
" " Round, weight of..... 45
" " " feet in bundle..... 107
" Beams and Channels..... 179
" Boiler, strength and weight... 31
" Columns.....49, 55
" Flat, weight of..... ..... 65 to 71
" " feet in bundle..... 107
" Flues, weight of..... 59
" " strength of..... 155
" Hoop, weight of..... 47
" Pipe, Flange..... 49
" " Cast..... 27
" " Riveted 77
" Plate, weight of.....39, 41
" Round, " 45
" " feet in bundle 107
" Square, " " 107
" " weight of..... 43
" Scroll, " 47
" Sheet, " 39
" Tests of..... 177
" Tire, weight of 47
" Tubes..... 37
" " Artesian, heavy..... 57
" " " light..... 59
" Value of.....99, 101

PAGE.
Iron Wire, weight of..... 51

Joints per mile of track.....121, 263

Lead Pipes..... 125
" Bar and Sheet, weight of..... 117
Leather Glue..... 207
" Belting Cement..... 209
" " power, &c..... 261
Liquid Measure..... 193
Locomotives on Levels and Grades.. 129
" Power, Loads, &c..... 149
Locks..... 205
Long Measure..... 187
" French..... 187

Measure, Board.. .....157 to 163
" Tables of.....187 to 193
Mensuration.....195, 197
Metals, specific gravity..... 93
Mills, Saw..... 257
" Wind..... 85
Money, Foreign..... 199

Nails, number to pound..... 131
Nitro-Glycerine..... 183
Nuts—sizes, weights, &c.....141

Oil Well Tubing.....57, 59

Padlocks..... 205
Paint for Tarpaulins..... 79
Paste.....131, 181
Pipes, Cast Iron..... 27
" Flange..... 49
" Lead..... 125
" Contents of..... 103
Pitch of Teeth.....167 to 173
Plate Iron, weight of 39, 41
Pressure on Boiler Iron..... 31
" of Steam on Piston..... 149
Prussian Railways.....133, 135
Pulleys and Blocks..... 107
" speed of..... 211
Putty 75

Rails per mile of track.....119, 121, 263
Railways, English.. .....137, 139
" Prussian.....133, 135
Resistance to Trains..... 151
Revolutions of Driving Wheels per mile..... 79
Riveted Copper Pipes..... 105
" Iron Pipes..... 77
Rivets, weight of..... 33
Roadway, Acres for..... 53
Ropes, Flat..... 83
" Hempen 113
" Round.....87, 89
Round Bar Iron, weight of..... 45
" " feet in bundle..... 107
Rubber Car Springs..... 61

Saw Mills..... 257
Sealing Wax..... 139
Sides of Squares, Equal to Circles.... 219
Shafts, digging of..... 97
Shells of Boilers, strength of..... 153
Sheet Brass, weight of..... 63
" Copper, " 117, 123
" Iron, " 39, 41

Hosted by Google

SILVER MEDAL AWARDED

AT THE

CINCINNATI INDUSTRIAL EXPOSITION,

TO THE

Merchants' Manuf'g and Construction Co.

(TELEGRAPH CONTRACTORS,

PROPRIETORS OF THE

SELDEN PATENT PRINTING TELEGRAPH INSTRUMENT,)

FOR THE

"Best Printing Telegraph Instruments

FOR

PRIVATE USE."

☞ This Company is prepared to build Telegraph Lines for Railroad or other Corporations, or for private Individuals, on Favorable Terms, applying the above Printer, or any other instrument.

W. C. JOY, *President.*
S. J. BURRELL, *Sec'y.*

Merchants' Manufacturing and Construction Co.,
50 BROAD STREET,
P. O. Box 6865. **NEW YORK.**

☞ *SEND FOR CIRCULAR.* ☜

Hosted by Google

PAGE.
Sheet Lead, weight of..... 117
Slate..... 203
Speed Table of Trains..... 23
Specific Gravity, Metals and Alloys 93
" " Wood..... 95
Spikes, Railroad and Ship..... 91
" per mile of track..... 121
Splices, per mile of track..... 119
Springs, Rubber..... 61
" Steel..... 201
Square Bar Iron, weight of. 43
" " feet in bundle..... 107
" Measure..... 189
Squares of Numbers.....237 to 271
Square Roots of Numbers.....237 to 271
Squares, sides of equal to circles..... 219
Steam, elasticity of, &c..... 81
" pressure on Piston..... 149
Steel, Plate and Sheet.....39, 41
" Springs..... 201
" Tempering 143
" Tests of..... 177
" Wire, weight of..... 51
Surface Hardening Cast Iron..... 77
Surveying Measure..... 187

Tacks, weight of..... 131
Tanks, Water..... 25
Teeth of Wheels.....167 to 173
Telegraph Wires.....213, 217
Tempering Gravers and Drills..... 21
" Steel 143
Tests of Iron and Steel..... 177
Thermometers 215
T. Iron, Weight of.....145, 147
Timber, Measure..... 165
Time..... 187
Tire Iron, Weight of..... 47
Tracing Paper..... 121
Tractive Power of Locomotives..... 149
Trains, Speed Table..... 23
Troy Weight..... 185
Tubes, Artesian.....57, 59
" Iron..... 37
" Welded..... 215
Value of Iron.....99, 101
Velocity of Wind..... 79
" Falling Bodies..... 105

PAGE.
Washers, Sizes and Weights..... 143
Water Stations and Tanks..... 25
Wells, Digging of..... 97
Weights—Angle Iron.....145, 147
" Apothecaries..... 185
" Avoirdupois..... 185
" Bar Iron.....43, 45
" Bolts, &c..... 29
" Boiler Iron..... 31
" Cast Iron Pipes..... 27
" Copper Rods..... 75
" Distribution on Locomotives..... 149
" French..... 185
" Hoop Iron..... 47
" Flat Iron.....65 to 71
" Grindstones..... 211
" Lead..... 117
" Lead Pipes..... 125
" Plate Iron.....39, 41
" Rivets..... 33
" Ropes. 83, 89
" Round Bar Iron..... 45
" Sheet Iron 39, 41
" Square Bar Iron..... 43
" Scroll Iron..... 47
" Tire Iron 47
" T. Iron.....145, 147
" Troy..... 185
" Washers..... 143
" Wheels 175
" Wire..... 51
" Wood 95
" Wrought Iron Tubes..37, 73
Wheel Gearing .....167 to 173
Wheels, Sizes and Weights..... 175
Whitewash..... 131
Wind Mills 85
" Velocity and Force of..... 79
Wire Gauges 35
" Telegraph.....213, 217
" Weight of..... 51
" Ropes 83, 87, 89
Wood, Specific Gravity and Weight. 95
Wood Working Machinery..... 207
Wrought Iron Tubes..... 37
" " Flues, strength of.... 155

Another edition of this work will be issued in spring of 1874; all parties desiring to be supplied with it will please send their address to

E. W. BULLINGER, 75 Fulton St., N. Y.

Or apply to any of the advertisers herein, on or about Feb. 1st, 1874.

Hosted by Google

ISAAC U. COLES,

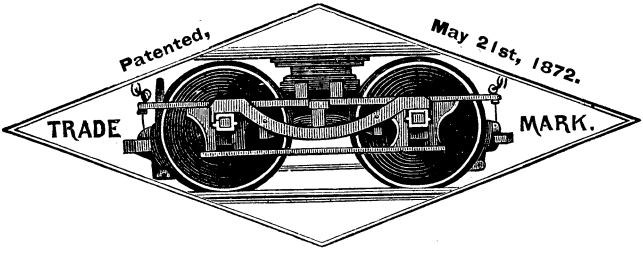
SOLE PROPRIETOR AND MANUFACTURER OF

Patent Tallow Packing for Car Journals,

TALLOW LUBRICATOR AND OIL

FOR MARINE AND STATIONARY ENGINES.

Superintendents, Master Mechanics and Engineers of many prominent Railway Companies, who have tested the **Patent Tallow Packing for Car Journals,** have expressed to me in writing, surprise and satisfaction at its performance, and many of them pronounce it superior to any article heretofore introduced to them for ***Lubricating Purposes,*** and as a RELIABLE PREVENTIVE OF HOT AXLES.



ITS CHARACTERISTICS ARE:

It excludes dust from the journal.
It causes the brasses to wear level.
It can be used in any kind of boxes.
It cannot be spilled out.
It is not affected by difference of climate.
It lubricates more thoroughly.
It requires very little labor and attention.
It is considerably cheaper than any other good lubricating material

The TALLOW LUBRICATOR for Marine and Stationary Engines, and MACHINE OIL, possess advantages over every other similar compound. I wish to secure patronage mainly upon the merits of my materials, therefore, do not here present copies of the many testimonials to be seen at my office from parties who have extensively tested and used the same. My request is "BE YOUR OWN JUDGE."

All Orders for Sample Packages are promptly filled at the office,

20 Cortlandt St., Room 5,

P. O. Box 2963. New York.

Hosted by Google

BUSINESS DIRECTORY.

Different Articles and Lines of Business in Alphabetical Order, with names of Dealers.

The arrangement of the names, under the various heads in the following Directory, was made by direction of advertisers, and not at the discretion of the publisher.

Adzes.

G. B. Walbridge.....New York.....See Page 130
Vose, Dinsmore & Co..... " " ..... " 60

Air Brakes.

Ward Air Brake Co.....Kalamazoo, Mich.....See Page 56

Air Compressors.

Rand & Waring Drill & Compressor Co.....New York.....See Front Page

Air Pumps.

J. B. Waring.....New York.....See Page 24

Angle Iron.

Jones & Laughlins.....Pittsburgh, Pa..... See Page 32
J. T. Ryerson.....Chicago, Ill..... " 180
Rogers & Co..... " " ..... " 144
Tyng & Co.....New York..... " 260
Vose, Dinsmore & Co..... " ..... " 60

Annunciators.

Chas. T. Chester.....New York .....See Page 212
Geo. H. Bliss & Co.....Chicago, Ill..... " 164
M. A. Buell..... .....Cleveland, Ohio..... " 46
Winans & Co..... .....New York..... " 106

Anti-Explosives.

Wiard Locomotive Attachment Co.....New York.....See Page 110

Anti-Friction Agents.

Isaac U. Coles..... .....New York .....See Page 20
Wm. B. Browne & Co ..... " " ..... " 266
See also, Oils, &c.

Anti-Friction Bearings.

G. W. W. Stevens & Co.....New York.....See Page 8
John Harden..... " " ..... " 230

TEMPERING GRAVERS AND DRILLS.

A watchmaker in Gosling, by the name of Schussleder, has recently published his method of hardening gravers and drills, which he claims renders them almost as hard as the diamond. He first heats the tool to a white heat, and then presses it into a stick of sealing wax, leaves it but a second there, and then sticks it into the wax in another place. This operation is rapidly repeated, until the graver is too cool to enter the wax. Drills tempered in this manner will pierce the hardest steel tempered in the usual manner. In turning or drilling, the tool is moistened with oil of turpentine.

Hosted by Google

PHILLIPSBURG MANUFACTURING CO.

NEW YORK OFFICE, 23 DEY STREET.

WORKS AT PHILLIPSBURG, N. J.

DANIEL RUNKLE, President.

ALF. P. BOLLER,
Vice-Pres't and Engineer.

JAMES CHRISTIE,
Superintendent.

WM. RUNKLE,
Treasurer and Sec'y.

J. W. GASKILL,
General Agent.

Engineers and Contractors,

FOR THE CONSTRUCTION OF

IRON BRIDGES,

ROOFS, VIADUCTS,

SUSPENSION BRIDGES,

AND

ENGINEERING IRON WORK

IN GENERAL.

ALSO *MANUFACTURERS* OF

SPLICE BOLTS, NUTS,

LIGHT FORGINGS,

BRIDGE, ROOF, and

MACHINE BOLTS.

☞ PLANS, ESTIMATES, &c., FURNISHED ON APPLICATION. ☜

Hosted by Google

Anti-Friction Metal.

Du Plaine & Reeves.....Philadelphia, Pa.....See Page 102
G. W. W. Stevens & Co.....New York..... " 8
Hook's Smelting Co.....Philadelphia, Pa..... " 216
Philadelphia Smelting Co..... " " ..... " 134

Anti-Friction Slide Valve.

Geo. W. Rich rdson & Co.....Troy, N. Y.....See Page 50

Antimony.

Bruce & Cook.....New York.....See Page 112
Lucius Hart & Co..... " " ..... " 56
Philadelphia Smelting Co.....Philadelphia, Pa..... " 134
Wm. Green & Co.....Wilmington, Del..... " 248

Anti-Vacuum Valve.

Geo. W. Richardson & Co .....Troy, N. Y .....See Page 50

Anvil Blocks.

The Atlas Works.....Pittsburgh, Pa.....See Page 172

Anvils.

Hermann Boker & Co..... .....New York.....See Pages 152, 154
Reese, Graff & Wood.....Pittsburgh, Pa.....See Page 68

Artesian Well Tubing.

Evans, Dalzell & Co..... .....Pittsburgh, Pa..... .....See Page 58
J. T. Ryerson.....Chicago, Ill..... " 180
Morris, Tasker & Co.....Philadelphia, Pa..... " 36

Asbestos.

H. W. Johns .....New York.....See Page 224

SPEED TABLE FOR TRAINS.

(*Molesworth.*)

Speed per hour.	Time of Performing.						Speed per hour.	Time of Performing.					
	¼ Mile.		½ Mile.		1 Mile.			¼ Mile.		½ Mile.		1 Mile	
Mls.	m. s.		m. s.		m. s.		Mls.	m. s.		m. s.		m. s.	
5	3 0	.....	6 0	.....	12 0		33	0 27	.....	0 54	.....	1 49	
6	2 30	.....	5 0	.....	10 0		34	0 26	.....	0 53	.....	1 46	
7	2 8	.....	4 17	.....	8 34		35	0 25	.....	0 51	.....	1 43	
8	1 52	.....	3 45	.....	7 30		36	0 25	.....	0 50	.....	1 40	
9	1 40	.....	3 20	.....	6 40		37	0 24	.....	0 48	.....	1 37	
10	1 30	.....	3 0	.....	6 0		38	0 23	.....	0 47	.....	1 34	
11	1 21	.....	2 43	.....	5 27		39	0 23	.....	0 46	.....	1 32	
12	1 15	.....	2 30	.....	5 0		40	0 22	.....	0 45	.....	1 30	
13	1 9	.....	2 18	.....	4 37		41	0 21	.....	0 43	.....	1 27	
14	1 4	.....	2 8	.....	4 17		42	0 21	.....	0 42	.....	1 25	
15	1 0	.....	2 0	.....	4 0		43	0 20	.....	0 41	.....	1 23	
16	0 56	.....	1 52	.....	3 35		44	0 20	.....	0 40	.....	1 21	
17	0 53	.....	1 46	.....	3 41		45	0 20	.....	0 40	.....	1 20	
18	0 50	.....	1 40	.....	3 20		46	0 19	.....	0 39	.....	1 18	
19	0 47	.....	1 34	.....	3 9		47	0 19	.....	0 38	.....	1 16	
20	0 45	.....	1 30	.....	3 0		48	0 18	.....	0 37	.....	1 15	
21	0 42	.....	1 25	.....	2 51		49	0 18	.....	0 36	.....	1 13	
22	0 40	.....	1 21	.....	2 43		50	0 18	.....	0 36	.....	1 12	
23	0 39	.....	1 18	.....	2 36		51	0 17	.....	0 35	.....	1 10	
24	0 37	.....	1 15	.....	2 30		52	0 17	.....	0 34	.....	1 9	
25	0 36	.....	1 12	.....	2 24		53	0 17	.....	0 34	.....	1 7	
26	0 34	.....	1 9	.....	2 18		54	0 16	.....	0 33	.....	1 6	
27	0 33	.....	1 6	.....	2 13		55	0 16	.....	0 32	.....	1 5	
28	0 32	.....	1 4	.....	2 8		56	0 16	.....	0 32	.....	1 4	
29	0 31	.....	1 2	.....	2 4		57	0 15	.....	0 31	.....	1 3	
30	0 30	.....	1 0	.....	2 0		58	0 15	.....	0 31	.....	1 2	
31	0 29	.....	0 58	.....	1 56		59	0 15	.....	0 30	.....	1 1	
32	0 28	.....	0 56	.....	1 52		60	0 15	.....	0 30	.....	1 0	

Hosted by Google

J. B. WARING,

ENGINEER.

AGENT FOR THE SALE OF THE

Norwalk. { Patented Balance Valve } Steam Engines

AND

EARLE'S PATENT STEAM PUMPS.

STATIONARY & PORTABLE ENGINES,

DIRECT ACTING AND BALANCE WHEEL PUMPS,

AIR AND VACUUM PUMPS,

AIR COMPRESSORS, ROCK DRILLS,

AND

Mining Machinery.

STEAM BOILERS

of every description on hand and made to order.

Designs and Working Drawings of Machinery

WITH SPECIFICATIONS FURNISHED.

Wrought and Cast Iron Pipe, with Fittings in great variety, constantly on hand.

J. B. WARING,

(Late Supt. Norwalk Iron Works,)

133 Centre Street, New York.

Hosted by Google

Asbestos Boiler Felting.
H. W. Johns ..... New York ..... See Page 224

Asbestos Roofing.
H. W. Johns ..... New York ..... See Page 224

Asphaltum.
H. W. Johns ..... New York ..... See Page 224

Assayers.
Du Plaine & Reeves ..... Philadelphia, Pa ..... See Page 102

Augur Ratchets.
Barwick Wrench Co ..... Boston, Mass ..... See Page 60

Automatic Gear Cutting Machines.
Wm. Sellers & Co ..... Philadelphia, Pa ..... See Page 64

Axe Manufacturers.
G. B. Walbridge ..... New York ..... See Page 130
Geo. Worthington & Co., Wholesale Dealers .... Cleveland, Ohio ..... " 100
Vose, Dinsmore & Co ..... New York ..... " 60

Axle Grease.
Frazer Lubricator Co ..... New York ..... See Page 264

WATER STATIONS.

The following is taken from Trautwine, and is a fair sample of his comprehensive and valuable method of treating all subjects.

SIZES OF TANKS AND CONTENTS.

Diam.	Depth.	Gallons.	Diam.	Depth.	Gallons.
Ft.	Ft.		Ft.	Ft.	
12	8	6767	24	12	40607
14	9	10363	26	13	51628
16	9	13535	28	14	64481
18	10	19034	30	15	79310
20	10	23499	32	16	96253
22	11	31277	34	17	115451

Cypress or any of the pines answer very well for tanks. The staves may be about 2½ ins. thick for the smaller ones; to 4 or 5 ins for the largest. The bottoms may be the same. The staves should be planed by machinery to suit the curve precisely. Nothing is then needed between the staves to produce tightness. A single wooden dowel is inserted between each two near the top, merely to hold them in place while being put together. The bottom is dowelled together, and simply inserted into a groove very accurately cut, about an inch deep, around the inner circumference of the tub, at a few inches above the bottoms of the staves.

One of 20 feet diameter, and 12 feet deep, may have 9 hoops of good iron, placed several inches nearer together at the bottom of the tank than at the top. Their width 3 inches; the thickness of the lower two, ¼ inch; thence gradually diminishing until the top one is but half as thick. The lower two are driven close together. These dimensions will allow for the rivet-holes for riveting together the overlapping ends; and for a moderate strain in driving the hoops firmly into place. Three rivets of ½ inch diameter, and 3 inches apart, in line, are sufficient for a joint of a lower hoop. One of 34 feet diameter, 17 deep, may have 12 hoops; the lower ones 4 inches by ½; with three ¾ inch rivets to a lower hoop-joint.

The bottom planks of the tank must bear firmly upon their supporting joists, or bearers.

A tank must have a waste pipe for preventing overflow, and a discharge or feed pipe 7 or 8 inches diameter, in or near the bottom. The inner end of the discharge pipe is covered by a valve, to be opened at will by the engine man, by means of an outside cord and lever. To its outer end is generally attached a flexible canvas and gum-elastic hose about 7 or 8 inches diameter and 8 or 10 feet long, through which the water enters the tender-tank. Or, instead of a hose, the feed-pipe may be prolonged by a metallic pipe, or nozzle, sufficiently long to reach the tender; and so jointed as, when not in use, to swing to one side, or to be raised to a vertical position.

Hosted by Google

PANCOAST & MAULE,

227 PEAR STREET,

PHILADELPHIA, PA.

WROUGHT IRON PIPE

PLAIN AND GALVANIZED.

CHARCOAL IRON BOILER TUBES.

Fittings for Gas, Steam and Water

OF EVERY DESCRIPTION.

BRASS COCKS AND VALVES.

IRON COCKS AND VALVES.

LUBRICATORS AND OIL CUPS.

STEAM WHISTLES.

WATER GAUGES.

TALLOW CUPS.

And a general assortment of Rough and Finished Work for

ENGINEERS and MACHINISTS.

Tools of Every Description,

FOR STEAM FITTERS' USE.

☞ **Send for Illustrated Catalogue and Price List,**

which will be mailed on application.

Hosted by Google

Axle Lathes.

Isaac H. Shearman.....Philadelphia, Pa..... ..See Page 80
Wm. Sellers & Co..... " " ..... " 64

Axles.

Anderson & Woods.....Pittsburgh, Pa.....See Page 150
De Laney & Co.....Buffalo. N. Y..... " 98
Greene & Randolph.....New York..... " 54
Jno. A. Griswold & Co.....Troy, N.Y..... " 50
Jones & Laughlins.....Pittsburgh, Pa..... " 32
L. G. Tillotson & Co.....New York..... " 94
Pittsburgh Forge & Iron Co.....Pittsburgh, Pa..... " 174
Vose, Dinsmore & Co. .....New York..... " 60

Babbitt Metal.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116
Champlin & Rogers.....Chicago, Ill..... " 192
Crane Bros. Mfg. Co..... " " ..... " 230
Du Plaine & Reeves.....Philadelphia, Pa..... " 102
J. J. Walworth..... .....Chicago, Ill..... " 124
Lucius Hart & Co.....New York..... " 56
Phelps & Sanger .....Cleveland, Ohio..... " 120
Philadelphia Smelting Co.....Phila elphia, Pa..... " 134
Wm. Green & Co..... .....Wilmington, Del..... " 248

WEIGHT OF CAST IRON PIPES.

Weight of a Foot of Cast Iron Pipes, in Pounds.

Two Flanges are equal to One Foot of Length, in Weight.

Bore Inch.	Th ck-ne s of Metal	Weight.	Bore Inch.	Thick-ness of Metal.	Weight.	Bore Inch.	Thick-ness of Metal.	Weight.
1	3/8	5.6	7	3/8	27.3	12	5/8	77.5
1	1/2	7.4	7	1/2	36.8	12	3/4	91.0
1 1/2	3/8	6.9	7	5/8	46.9	12	7/8	110.8
1 1/2	1/2	6.8	7	3/4	56.9	12	1	127.9
2	3/8	8.7	7 1/2	1/2	39.3	14	5/8	89.6
2	1/2	12.0	7 1/2	5/8	50.	14	3/4	108 8
2 1/2	3/8	10.5	7 1/2	3/4	61.	14	7/8	127.9
2 1/2	1/2	14 9	8	3/8	30 8	14	1	147.5
3	3/8	12.4	8	1/2	41.8	15	3/4	115.9
3	1/2	17.2	8	5/8	52.9	15	7/8	137.
3	5/8	22.2	8	3/4	64.5	15	1	157.8
3 1/2	3/8	14.3	8 1/2	1/2	44.2	15	1 1/8	17[illegible].7
3 1/2	1/2	19.8	8 1/2	5/8	56.	16	3/4	123.
3 1/2	5/8	2[illegible].3	8 1/2	3/4	68.2	16	7/8	144.7
4	3/8	16.1	9	3/8	34 6	16	1	166.9
4	1/2	22.1	9	1/2	46 7	16	1 1/8	189 7
4	5/8	28.4	9	5/8	58 9	18	3/4	138 9
4 1/2	3/8	18.1	9	3/4	71 9	18	7/8	162 8
4 1/2	1/2	24.5	9 1/2	1/2	49 1	18	1	18[illegible].8
4 1/2	5/8	31.4	9 1/2	5/8	62.2	18	1 1/8	211.8
5	3/8	19.8	9 1/8	3/4	7[illegible].6	20	7/8	17[illegible].0
5	1/2	27.0	10	1/2	51.6	20	1	[illegible]0[illegible]8
5	5/8	34.5	10	5/8	6[illegible].3	20	1 1/8	233.9
5	3/4	42.4	10	3/4	79 3	20	1 1/4	[illegible]61.3
5 1/2	1/2	29.6	10	7/8	93.5	22	1	227.4
5 1/2	5/8	37.6	1[illegible] 1/2	1/2	54.	22	1 1/8	255.9
5 1/2	3/4	46.	10 1/2	5/8	68.3	22	1 1/4	28[illegible].8
6	3/8	23.4	10 1/2	3/4	83.	24	1	245.0
6	1/2	31.9	11	1/2	56.5	24	1 1/8	277.9
6	5/8	40 7	11	5/8	71 5	24	1 1/4	311.3
6	3/4	49.9	11	3/4	86.6			
6 1/2	1/2	34.4	11	7/8	101 9			
6 1/2	5/8	43.7	11 1/2	1/2	59.			
6 1/2	3/4	53 4	11 1/2	5/8	74.5			
			11 1/2	3/4	90.5			

Hosted by Google

HOOPES & TOWNSEND

MANUFACTURE

MACHINE and CAR-BOLTS,

COLD PRESSED

Square AND Hexagon Nuts,

WASHERS,

RIVETS,

WOOD SCREWS,

BRIDGE RODS,

CAR FORGINGS.

No. 1330 Buttonwood St.,

PHILADELPHIA.

Hosted by Google

Badges.

L. G. Tillotson & Co.. .....New York.....See Page 94
W. W. Wilcox.....Chicago, Ill..... " 190

Baggage Barrows.

A. M. Gilbert & Co.....Chicago, Ill.....See Page 180
W. A. Dobinson & Co.....Buffalo, N. Y..... ,' 196

Baggage Checks.

L. G. Tillotson & Co.....New York.....See Page 94
W. W. Wilcox.....Chicago, Ill..... " 190

Baker's Tile.

Philip Neukumet.....Philadelphia, Pa.....See Page 104

Ball Pene Hammers.

Hermann Boker & Co.....New York.....See Pages 152, 154
Nelson Tool Works..... " .....See Page 30

Band Saws.

Buffalo Machinery Agency.....Buffalo, N. Y.....See Page 160
C. Van Ness..... New York..... " 70
J. A. Fay & Co.....Cincinnati, Ohio. ..... " 206
J. T. & R. H. Plass.....New York..... " 208
Richards, London & Kelley.....Philadelphia, Pa..... " 66
Vose, Dinsmore & Co.....New York..... " 60

Band Sawing Machines.

J. A. Fay & Co.....Cincinnati, Ohio.....See Page 206
J. T. & R. H. Plass..... .....New York..... " 208
Richards, London & Kelley.....Philadelphia, Pa..... " 66

Bar Iron.

See Iron—Bar.

Bark Mills.

R. L. Howard & Son.....Buffalo, N. Y.....See Page 40

Bar Lead.

Bruce & Cook .....New York.....See Page 112

Bars.

Pittsburgh Bolt Co.....Pittsburgh, Pa.....See Page 118

BOLTS WITH SQUARE HEADS AND NUTS.

Weight of 100, *in Pounds.*

Length Inches.	Thickness of Bolt in Inches.						
	¼	5/16	⅜	7/16	½	⅝	¾	⅞
1½	4.16	7.59	10.62	15.94	23.87	39.31		
¾	4.22	7.87	11.72	16.90	25.06	41.38		
2	4.75	8.56	12.38	18.25	26.44	45.69	73.62	
¼	5.34	9.12	12.90	19.38	28.62	49.50	76.	
½	5.97	9.59	14.69	20.69	29.50	51.25	79.75	
¾	6.50	10.44	16.47	21.50	31.16	53.	83.	
3		10.78	17.87	22.38	32.44	56.	85.38	127.25
½		11.81	18.94	26.19	39.75	63.12	93.44	140.56
4			20.59	28.87	42.50	74.87	108.12	148.37
½			21.69	29.87	44.87	79.62	113.12	158.76
5			23.62	32.31	48.81	83.	122.	167.25
½			25.81	34.44	51.38	87.88	128.62	174.88
6			16.87	36.62	53.31	92.38	131.75	204.25
½					56.87	96.88	139.56	214.69
7					59.12	99.87	145.50	228.44
½					61.87	105.75	150.88	235.31
8					64.44	109.50	157.12	239.88
9					70.50	118.12	169.62	258.12
10					77.	128.13	184.	276.18
11					82.88	136.19	195.13	295.69
12					86.37	144.87	209.75	311.94
13					92.	155.50	219.37	335.81
14					97.75	163.58	237.50	351.88
15					103.25	170.75	249.05	391.75

Hosted by Google

TOOLS

MANUFACTURED BY THE

Nelson Tool Works,

157 East 32d Street, New York.

LIST OF TOOLS IN SETS.

Boiler Makers' Tools.	Slaters' Roofing Tools.
Track Layers' "	Horseshoers' "
Blacksmiths' "	Machinists' "
Blasting "	Stone Masons' "

Quarry Tools.

Gas and Water-Pipe Caulking Tools.

File Cutters' Hammers.	Coopers' Hammers.
Concrete "	Ship Mauls.

NELSON'S SOLID EYED PICKS.

H. NELSON'S CELEBRATED IRON PLOW

FOR

Street and Railroad Grading.

MINING AND PAVING TOOLS. STRIKING HAMMERS,

PICKS, STONE BREAKERS' SLEDGES,

BLACKSMITHS' SWEDGES, SWEDGE BLOCKS, FULLERS,

SLEDGES AND HAMMERS,

OF EVERY DESCRIPTION.

☞ *Hammers of all kinds Made to Order on receipt of Pattern or Drawing.*

HORSE SHOERS and BLACKSMITHS' TOOLS.

Special Attention Paid to Railroad Work.

☞SEND FOR ILLUSTRATED PRICE LIST.☜

GEORGE W. MENOMY.

Hosted by Google

Batteries—Telegraph.

Leclanche Battery Co.....New York..... ....See Page 96
See also, Telegraph Apparatus.

Bellows.

England & Bindley.....Pittsburgh, Pa.....See Page 162
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Joseph Churchyard.....Buffalo, N. Y..... " 160
Newcomb Bro's. Sons.....New York..... " 88
Sidney Shepard & Co.....Buffalo, N. Y..... " 196
S. S. Townsend.....New York..... " 2
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138

Bells.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116
Vose, Dinsmore & Co.....New York..... " 60

Belt Dogs.

Champlin & Rogers.....Chicago, Ill.....See Page 192

Belting.

Bickford, Curtiss & Deming.....Buffalo, N. Y.....See Page 136
Buffalo Machinery Agency..... " " ..... " 160
Champlin & Rogers.....Chicago, Ill..... " 192
Darrow, Turner & Co.....New York..... " 62
D. Brewer & Co.....Philadelphia, Pa..... " 246
Erie City Iron Works.....Erie, Pa..... " 170
George Worthington & Co.....Cleveland, Ohio..... " 100
Goodyears I R. G. Mfg. Co.....New York..... " 252
New York Rubber Co..... " ..... " 260
N. H. Gardner & Co.....Buffalo, N. Y..... " 254
Radley & McAlister Mfg. Co.....New York..... " 250
Sidney Shepard & Co.....Buffalo, N. Y..... " 196
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138
Vose, Dinsmore & Co.....New York..... " 60

Bench Screws—Iron and Wooden Handles.

Hermann Boker & Co.....New York.....See Pages 152, 154

THICKNESS OF BOILER IRON REQUIRED AND PRESSURES ALLOWED BY THE LAWS OF THE U. S.

Pressure equivalent to the Standard for a Boiler 42-in. in Diameter and ¼ in Thick.

Thickness in 16ths.	Diameter. 34 Inches.	36 Inches.	38 Inches.	40 Inches.	42 Inches.	44 Inches.	46 Inches.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
5	169.9	160.4	152.	144.4	137.5	131.2	125.5
4½	158.5	149.7	141.8	134.7	128.3	122.5	117.2
4¼	147.2	139.1	131.8	125.1	119.2	113.7	108.8
4	135.9	128.3	121.6	115.5	110.	105.	100.
3⅔	124.5	117.6	111.4	105.9	100.8	96.2	92.
3½	113.2	106.9	101.3	96.2	91.7	87.5	83.
3	101.9	96.2	91.2	82.6	82.5	78.7	75.

WEIGHT AND THICKNESS OF BOILER IRON.

1-8 inch weighs... 5 pounds per sq. foot.
3-16 " " ... 7½ " "
1-4 " " ...10 " "
5-16 " " ...12½ " "
3-8 " " ...15 " "
7-16 " " ... 17½ " "
1-2 " " ...20 " "

No. 1 Iron is 5-16 inch thick.
No. 3 " nine-thirty-seconds.
No. 4 " 1-4 inch.
No. 5 " seven-thirty-seconds.
No. 7 " three-sixteenths.

Hosted by Google

American Iron Works.

JONES & LAUGHLINS,

PITTSBURGH, PA.

MANUFACTURERS OF

AMERICAN AND CLAIR

BAR, HOOP, SHEET and PLATE IRON,
BRIDGE IRON,
ANGLE AND T IRON,
GUARD IRON,
COAL SCREEN IRON,
CUT NAILS and SPIKES,
SHIP and BOAT SPIKES,
RAILROAD SPIKES,
T RAIL, 8, 12, 16, 20, 28 and 40 lbs. to yard,
TRAM RAILS, Punched and Countersunk,
RAILROAD FISH BARS and BOLTS,
COAL PIT CAR WHEELS and AXLES,
PATENT COLD ROLLED SHAFTING,
FINGER and KNIFE BARS,

PATENT COLD ROLLED PISTON RODS.

WAREHOUSES AND OFFICE:

Second & Third Avenues, and Try Street,

PITTSBURGH, PA.

BRANCH HOUSE:

Nos. 190 to 196 South Canal Street, Chicago, Ill.

Hosted by Google

Bending Rolls.

Wm. B. Bement & Son.....Philadelphia, Pa.....See Page 168
Wm. Sellers & Co..... " " ..... " 64

Bismuth.

Lucius Hart & Co.....New York.....See Page 56

Black Lead.

T. B. Bickerton & Co.....Philadelphia, Pa.....See Page 138

Blacksmith's Tools.

Hermann Boker & Co.....New York.....See Pages 152, 154
Nelson Tool Works..... " " .....See Page 30

Blank Books.

Allen, Lane & Scott.....Philadelphia.....See Page 90
Chas. F. Ketcham.....New York..... " 262
Warren, Johnson & Co.....Buffalo, N. Y..... " 100

Blasters' Tools.

Geo. W. Mowbray.....North Adams, Mass.....See Page 182
Nelson Tool Works.....New York..... " 30
Rand & Waring Drill & Compressor Co..... " .....See Front Page

Blast Furnaces.

The Atlas Works.....Pittsburgh, Pa.....See Page 172

Blast Furnace Blocks.

Star Fire Brick Co.....Pittsburgh, Pa.....See Page 232
Philip Neukumet.....Philadelphia, Pa..... " 104
Maurer & Weber.....New York..... " 228

Blasting and Mining Wires.

Bishop Gutta Percha Works.....New York.....See Page 34
Geo. W. Mowbray.....North Adams, Mass..... " 182

Blind and Sash Makers.

Joseph Churchyard.....Buffalo, N. Y.....See Page 160

Blocks.

Providence Tool Co.; H. B. Newhall, Agent....New York.....See Page 186

Block Tin.

Bruce & Cook.....New York.....See Page 112
Lucius Hart & Co..... " " ..... " 56

Blowers.

Wm. B. Bement & Son.....Philadelphia, Pa.....See Page 168
Phelps & Sanger.....Cleveland, Ohio..... " 120
S. S. Townsend.....New York..... " 2

NUMBER OF BURDEN'S RIVETS IN 100 LBS.

Length Inches.	Thickness in Inches.			
	½	⅝	11/16	¾
¾	1,092	665		
⅞	1,027	597		
1	940	538	450	
1⅛	840	512	415	
1¼	797	487	389	356
1⅜	760	460	370	329
1½	730	440	357	280
1⅝	711	420	340	271
1¾	693	390	325	262
1⅞	648	375	312	257
2	608	360	297	243
2⅛	573	354	289	237
2¼	555	347	280	232
2½	525	335	260	220
2¾	500	312	242	208
3	460	290	224	197

Length Inches.	Thickness in Inches.			
	½	⅝	11/16	¾
3¼	433	267	212	180
3½	413	248	201	169
3¾	395	241	192	160
4		230	184	158
4¼		220	177	150
4½		210	171	146
4¾		200	166	138
5		190	161	135
5¼		180	156	130
5½		172	151	124
5¾		164	145	120
6		157	140	115
6¼		150	138	111
6½		146	134	107
6¾		143	129	104
7		140	125	100

Hosted by Google

THE BISHOP GUTTA PERCHA WORKS,

S. BISHOP,

Nos. 422, 424 & 426 EAST 25th STREET,

NEW YORK.

MANUFACTURE

Submarine Telegraph Cables

AND

Telegraph AND Electric Wires,

ALSO EVERY VARIETY, FOR

BLASTING AND MINING USE.

SILK AND COTTON COVERED WIRES OF SUPERIOR QUALITY

OFFICE WIRES OF EVERY DESCRIPTION.

WATER, BEER, SODA and ACID PIPES.
CHEMICAL VESSELS, FUNNELS and BOTTLES.
CRUDE GUTTA PERCHA for CEMENT.
BATHS and DISHES for ACIDS.
TISSUE SHEET for HATTERS. SURGICAL SHEET.
SHEET FOR ARTISTS AND MECHANICAL USES.

Hosted by Google

Boiler Covering.

H. W. Johns ..... New York ..... See Page 224
Van Tuyl Mfg. Co. ..... " ..... " 242

Boiler Felting.

H. W. Johns ..... New York ..... See Page 224
J. J. Walworth ..... Chicago, Ill. ..... " 124
T. B. Bickerton & Co. ..... Philadelphia, Pa. ..... " 138
Van Tuyl Mfg. Co. ..... New York ..... " 242
Vose, Dinsmore & Co. ..... " " ..... " 60

Boiler Iron.

P. H. Moffat ..... Chicago, Ill. ..... See Page 190
Tyng & Co. ..... New York ..... " 260
Vose, Dinsmore & Co. ..... " " ..... " 60
Wm. Green & Co. ..... Wilmington, Del. ..... " 248

Boiler Makers.

Erie City Iron Works ..... Erie, Pa. ..... See Page 170
J. B. Waring ..... New York ..... " 24
Snyder Bros. ..... Williamsport, Pa. ..... " 46
Speedwell Iron Works ..... New York ..... " 122
See also, Steam Boilers.

Boiler Makers' Tools.

Bolen, Crane & Co. ..... Newark, N. J. ..... See Page 62
Nelson Tool Works ..... New York ..... " 30
S. S. Townsend ..... " " ..... " 2
W. P. Kellogg & Co. ..... Troy, N. Y. ..... " 98

Boiler Plate and Drilling Machines.

Thorne, De Haven & Co. ..... Philadelphia, Pa. ..... See Page 38

Boiler Plates.

J. T. Ryerson ..... Chicago, Ill. ..... See Page 180
P. H. Moffat ..... " " ..... " 190
Vose, Dinsmore & Co. ..... New York ..... " 60

Boiler Powders.

H. N. Winans ..... New York ..... See Page 108

Boiler Ratchets.

Barwick Wrench Co. ..... Boston, Mass. ..... See Page 60

AMERICAN AND BIRMINGHAM WIRE GAUGES.

Thickness in Inches.

(Taken from Haswell.)

No. of Gauge.	Thick. of Am. G. Inch.	Thick. of Bir. G. Inch.	No. of Gauge.	Thick. of Am. G. Inch.	Thick. of Bir. G. Inch.	No. of Gauge.	Thick. of Am. G. Inch.	Thick. of Bir. G. Inch.
000	.46	.454	11	.0907	.12	25	.0179	.02
000	.4096	.425	12	.0808	.109	26	.0160	.018
00	.3648	.38	13	.0719	.095	27	.0142	.016
0	.3248	.34	14	.0641	.083	28	.0126	.014
1	.2893	.30	15	.057	.072	29	.0112	.013
2	.2576	.2-4	16	.0508	.065	30	.01	.012
3	.2294	.259	17	.0452	.058	31	.0089	.01
4	.2043	.238	18	.0403	.049	32	.0079	.009
5	.1819	.22	19	.0359	.042	33	.007	.008
6	.1620	.203	20	.0319	.035	34	.0-63	.007
7	.1443	.18	21	.0284	.032	35	.0056	.005
8	.1285	.165	22	.0253	.028	36	.005	.004
9	.1144	.148	23	.0225	.025			
10	.1019	.134	24	.0201	.022			

Hosted by Google

THOMAS T. TASKER, JR. STEPHEN P. M. TASKER

MORRIS, TASKER & CO.

PASCAL IRON WORKS,

Philadelphia, Pa.

TASKER IRON WORKS,

New Castle, Del.

OFFICE, FIFTH and TASKER STS., PHILADELPHIA.

Office and Warehouse, 15 Gold Street, New York.

Wrought Iron Welded Tubes

Plain and Galvanized, for Gas, Steam and Water.

LAP WELDED CHARCOAL IRON BOILER TUBES.

OIL WELL TUBING AND CASING.

Gas and Steam Fittings.

Brass Valves and Cocks.

GAS AND STEAM FITTERS' TOOLS.

Cast Iron Gas and Water Pipe. Street Lamp Posts and Lanterns.

IMPROVED COAL-GAS APPARATUS, &c.

Hosted by Google

WROUGHT IRON WELDED TUBES FOR STEAM, GAS, OR WATER.

1¼ inch and below, Butt Welded; proved to 300 Pounds per Square Inch, Hydraulic Pressure.
1½ inch and above, Lap " " 500 " " "

Table of Standard Sizes.--Morris, Tasker & Co.

Inside Diameter.	Actual Inside Diameter.	Actual Outside Diameter	Thickness.	Internal Circumference.	External Circumference.	Length of Pipe per sq. foot of inside surface.	Length of Pipe per sq. foot of outside surface.	Internal Area.	External Area.	Length of Pipe containing one cubic foot.	Weight per foot of length.	No. of threads per inch of screw.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Feet.	Feet.	Inches.	Inches.	Feet.	lbs.	
⅛	.270	.405	.068	.848	1.272	14.15	9.44	.0572	.129	2500.	.243	27
¼	.364	.54	.088	1.144	1.696	10.50	7.075	.1041	.229	1385.	.422	18
⅜	.494	.675	.091	1.552	2.121	7.67	5.657	.1916	.358	751.5	.561	14
½	.623	.84	.109	1.957	2.652	6.13	4.502	.3048	.554	472.4	.845	14
¾	.824	1.05	.113	2.589	3.299	4.635	3.637	.5333	.866	270.	1.126	11½
1	1.048	1.315	.134	3.292	4.134	3.679	2.903	.8627	1.357	166.9	1.670	11½
1¼	1.380	1.66	.140	4.335	5.215	2.768	2.301	1.496	3.164	96.25	2.258	11½
1½	1.611	1.9	.145	5.061	5.969	2.371	2.01	2.038	2.835	70.65	2.694	11½
2	2.067	2.375	.154	6.494	7.461	1.848	1.611	3.355	4.430	42.36	3.667	8
2½	2.468	2.875	.204	7.754	9.032	1.547	1.328	4.783	6.491	30.11	5.773	8
3	3.067	3.5	.217	9.636	10.996	1.245	1.091	7.388	9.621	19.49	7.547	8
3½	3.548	4.	.226	11.146	12.566	1.077	.955	9.887	12.566	14.56	9.055	8
4	4.026	4.5	.237	12.648	14.137	.949	.849	12.730	15.904	11.31	10.728	8
4½	4.508	5.	.247	14.153	15.708	.848	.765	15.939	19.635	9.03	12.492	8
5	5.045	5.563	.259	15.849	17.475	.757	.629	19.990	24.299	7.20	14.564	8
6	6.065	6.625	.280	19.054	20.813	.63	.577	28.889	34.471	4.98	18.767	8
7	7.023	7.625	.301	22.063	23.954	.544	.505	38.737	45.663	3.72	23.410	8
8	7.982	8.625	.322	25.076	27.096	.478	.444	50.039	58.426	2.88	28.348	8
9	9.001	9.688	.344	28.277	30.433	.425	.394	63.633	73.715	2.26	34.077	8
19	10.019	10.75	.366	31.475	33.772	.381	.355	78.838	90.762	1.80	40.641	8

Hosted by Google

CHAS. W. MATTHEWS,

(Late RALSTON & MATTHEWS)

133 WALNUT ST., PHILADELPHIA.

Iron and Steel Railroad and Street

RAILS,

OF BEST ENGLISH AND AMERICAN MAKES.

CHAIRS, SPIKES, FISH BARS,

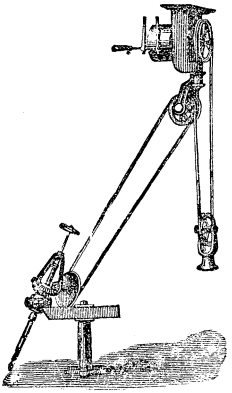
RAILROAD SUPPLIES,

MUCK BARS, OLD RAILS, SCRAP, BLOOMS,

AMERICAN AND SCOTCH

PIG IRON AND METALS.

☞ Freight and Passenger Cars and Locomotives. ☜



THORNE, DE HAVEN & CO.,

Twenty-First Street,

(Above Market) PHILADELPHIA,

BUILDERS OF

Patent Portable Drilling Machines,

MULTIPLE DRILLING MACHINES,

FOR DRILLING BOILER PLATES.

Radial Drilling Machines,

Horizontal Drilling and Boring Machines

Hosted by Google

Boiler Rivets.

Geo. Worthington & Co.....Cleveland, Ohio.....See Page 100
Radley & McAlister Mfg. Co.....New York..... " 250
Tyng & Co ..... " " ..... " 260
Vose, Dinsmore & Co..... " " ..... " 60
Wm. Gilmor of Wm.....Baltimore, Md..... " 248
See also, Rivets.

Boilers.

H. N. Winans, (Boiler Powders).....New York .....See Page 108
J. B. Waring..... " " ..... " 24
Van Tuyl Mfg. Co..... " " ..... " 242
Wiard Locomotive Attachment Co. (Anti-Explosive)...New York..... " 110
See also, Steam Boilers

Boiler Scale Preventive.

H. W. Johns .....New York.....See Page 224
H. N. Winans..... " " ..... " 108

Boiler Tubes and Flues.

A. Carr.....New York.....See Page 244
Buffalo Machinery Agency.....Buffalo, N. Y..... " 160
Evans, Dalzell & Co.....Pittsburgh, Pa..... " 58
J. J. Walworth.....Chicago, Ill..... " 124
J. T. Ryerson..... " " ..... " 180
Morris, Tasker & Co.....Philadelphia, Pa..... " 36
Pancoast & Maule..... " " ..... " 26
Phelps & Sanger.....Cleveland, Ohio..... " 120
Tyng & Co.....New York..... " 260
Vose, Dinsmore & Co..... " " ..... " 60

WEIGHT OF SHEET AND PLATE IRON.—2 PAGES.

Thickness by Birmingham Wire Gauge and Inches.

Weight of a Square Foot in Pounds.

B. W. Guage.	Thickness, Part of an inch.	Weight, Pounds.	B. W. Guage.	Thickness, Part of an inch.	Weight, Pounds.
36	.004	.162	11	.120	4.88
35	.005	.202		1/8 or .125	5.054
34	.007	.283	10	.134	5.426
33	.008	.322	9	.148	5.98
32	.009	.364		5-32 or .1562	6.305
31	.010	.405	8	.165	6.605
30	.012	.485	7	.180	7.27
29	.013	.526		3/16 or .1875	7.578
28	.014	.595	6	.203	8 005
27	.016	.676		7-32 or .2187	8.79
26	.018	.755	5	.22	8.912
25	.020	.811	4	.238	9.62
24	.022	.912		1/4 or .25	10.09
23	.025	1.018	3	.259	10.37
22	.028	1.137		9-32 or .2812	11.38
	1-32 or .03125	1.259	2	.284	11.525
21	.032	1.31	1	.3	12.15
20	.035	1.416		5/16 or .3125	12 58
19	.042	1.695	0	.340	13.715
18	.049	1.975		11-32 or .3437	13.875
17	.058	2.35		3/8 or .375	15.10
16	.065	2.637	00	.380	15.26
	1/16 or .0625	2.518		13-32 or .4062	16.34
15	.072	2.92	000	.425	17.125
14	.083	3.35		7/16 or .4375	17.65
	3-32 or .0937	3.78	0000	.454	18.30
13	.095	3.85		15-32 or .4687	18.90
12	.109	4.4	00000	1/2 or .50	20.20

For STEEL PLATES multiply tabular number above (for size), by 1.01.

Hosted by Google

BUFFALO SCALE CO.

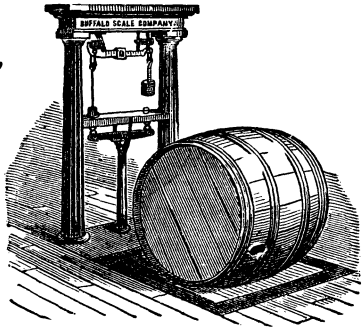
BUFFALO, N. Y.

MANUFACTURERS OF

IMPROVED RAILROAD SCALES

AND SCALES OF ALL DESCRIPTIONS.

Railroad Track, Depot, Platform, Iron, Rolling Mill AND Furnace Charging



Dormant, Hopper, Wheelbarrow, Grain, Hay, Coal AND Cattle SCALES, Etc., Etc.

Send for Illustrated Catalogue and Price List. *Every Scale Warranted.* We shall be pleased to correspond with Railroad Managers in relation to prices and terms. ADDRESS

JOHN R. LINEN, SECY., Buffalo, N. Y.

HOWARD IRON WORKS,

MANUFACTURERS OF

BUFFALO POWER HOISTING MACHINES,

HOWARD'S PARALLEL BENCH VISE,

SCHLENKER'S BOLT CUTTER.

Address

R. L. HOWARD & SON,

BUFFALO, N. Y.

Hosted by Google

Bolt Cutters.

Isaac H. Shearman.....Philadelphia, Pa.....See Page 80
Phelps & Sanger.....Cleveland, Ohio..... " 120
R. L. Howard & Son.....Buffalo, N. Y..... " 40
Wm. B. Bement & Son.....Philadelphia, Pa..... " 168

Bolt Ends.

Pittsburgh Bolt Co.....Pittsburgh, Pa.....See Page 118
Plumb, Burdict & Barnard.....Buffalo, N. Y..... " 176
Wm. Gilmor of Wm.....Baltimore, Md..... " 248

Bolt Heading Machines.

Isaac H. Shearman.....Philadelphia, Pa.....See Page 80

Bolts.

Collier & Scranton, Oxford Iron Co.....New York.....See Page 122
G. B. Walbridge..... " " ..... " 130
Greene & Randolph..... " " ..... " 54
Hoopes & Townsend.....Philadelphia, Pa..... " 28
Jones & Laughlins.....Pittsburgh, Pa..... " 32
Lewis Oliver & Phillips; H. B. Newhall, Ag't. .New York..... " 166
Lock Nut & Bolt Co. of New York ..... " " ..... " 272
O. W. Child..... " " ..... " 262
Phillipsburg Mfg. Co..... " " ..... " 22
Pittsburgh Bolt Co.....Pittsburgh, Pa..... " 118
Plumb, Burdict & Barnard.....Buffalo, N. Y..... " 176
Reading Nut & Bolt W'ks; H. B. Newhall, Agt..New York..... " 166
Skinner & Gifford Mfg. Co.....Dunkirk, N. Y..... " 140
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138
Vose, Dinsmore & Co.....New York..... " 60
Wm. Gilmor of Wm.....Baltimore, Md..... " 248
Wm. Green & Co.....Wilmington, Del..... " 248

Bolt Screwing Machines.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Boring Bars.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Boring Implements.

Rand & Waring Drill & Compressor Co.....New York.....See First Page
Wm. P. Kellogg & Co.....Troy, N. Y.....See Page 98

WEIGHT OF SHEET AND PLATE IRON.—Continued.

Thickness in Inches—Weight of a Square Foot in Pounds.

Inches Thick.	Lbs. per Square Foot.	Inches Thick.	Lbs per Square Foot.	Inches Thick.	Lbs. per Square Foot.
9/16	22.5	1 3/4	70.62	3 7/8	156.51
5/8	25.21	13/16	73.14	4	161.55
11/16	27.75	7/8	75.58	1/8	166.6
3/4	30.25	15/16	78.20	1/4	171.66
13/16	32.75	2	80.75	3/8	176.71
7/8	35.26	1/8	85.75	1/2	181.77
15/16	37.75	1/4	90.81	5/8	186.79
1	40.35	3/8	95.86	3/4	191.84
1/16	42.87	1/2	100.9	7/8	196.9
1/8	45.4	5/8	105.95	5	201.85
3/16	47.9	3/4	111.	1/8	206.9
1/4	50.45	7/8	116.1	1/4	211.95
5/16	52.96	3	121.15	3/8	217.
3/8	55.45	1/8	126.21	1/2	222.05
7/16	58.01	1/4	131.26	5/8	227.1
1/2	60.52	3/8	136.32	3/4	232.15
9/16	63.05	1/2	141.37	7/8	237.2
5/8	65.56	5/8	146.41	6	242.25
11/16	68.11	3/4	151.46		

For STEEL PLATES multiply tabular number above (for size), by 1.01.

Hosted by Google

ALBERT C. MCNAIRY, Pres't. HARVEY T. CLAFLEN, Sup't.
HENRY M. CLAFLEN, V. Pres. & Treas. SIMEON SHELDON, Engineer.
JOHN COON, Secretary.

THE CLEVELAND BRIDGE AND CAR WORKS,

The McNairy & Claflen Manf'g Company, Proprietors,

BUILDERS OF

Railroad and Highway Bridges,

ROOFS, TURN TABLES and TRANSFER TABLES,

EITHER OF WOOD OR IRON.

Railroad Passenger and Freight Cars, Street Railroad Cars,

Post's Patent Iron and Combination Bridges, Howe Truss Bridges, with Patent Iron Clamps, Street Railroad Cars, with Higley's Patent Running Gear and Brake.

Offices, Waring Block, Bank & St. Clair Sts.
Works, On Wason, Hamilton & Lake Sts. } CLEVELAND, O.

CLEVELAND FOUNDRY

N. P. BOWLER
WM BOWLER
THOS MAHER
C. A. BRAYTON

9 11 & 13
WINTER
STREET

MANUFACTURERS OF

CAR WHEELS, CHILLED FACED FROGS,

RAILROAD, ROLLING MILL,

AND ALL OTHER KINDS OF **CASTINGS.**

BOWLERS, MAHER & BRAYTON.

Hosted by Google

Boring Machines.

Rand & Waring Drill & Compressor Co	New York	See First Page
The Pratt & Whitney Co	Hartford, Conn	See Page 142
Thorne, De Haven & Co	Philadelphia, Pa	" 38
Wm. B. Bement & Son	" "	" 168
Wm. P. Kellogg & Co	Troy, N. Y	" 98
Wm. Sellers & Co	Philadelphia, Pa	" 64

Brakes.

Vose, Dinsmore & Co	New York	See Page 60
Ward Air Brake Co	Kalamazoo, Mich	" 56

Brands—Burning.

Mathiesen & Schrader	New York	See Page 82

Brass.

Ansonia Brass & Copper Co	New York	See Page 122
Chas. W. Matthews	Philadelphia, Pa	" 38
Mathiesen & Schrader	New York	" 82
Sidney Shepard & Co	Buffalo, N. Y	" 196

Brass Castings.

A. Fulton's Son & Co	Pittsburgh, Pa	See Page 116
Du Plaine & Reeves	Philadelphia, Pa	" 102
Hook's Smelting Co	Philadelphia, Pa	" 216
McNab & Harlan Mfg. Co	New York	" 220
Philadelphia Smelting Co	Philadelphia, Pa	" 134

Brass Cocks & Valves.

A. Carr	New York	See Page 244
Crane Bros. Mfg. Co	Chicago, Ill	" 230
Hart, Ball & Hart	Buffalo, N. Y	" 136
J. J. Walworth	Chicago, Ill	" 124
McNab & Harlin Mfg. Co	New York	" 220
Morris, Tasker & Co	Philadelphia, Pa	" 36
Pancoast & Maule	" "	" 26
Vose, Dinsmore & Co	New York	" 60

Brass—Ingot.

Du Plaine & Reeves	Philadelphia, Pa	See Page 102

Brass Fittings.

McNab & Harlin Manufacturing Co	New York	See Page 220
Pancoast & Maule	Philadelphia, Pa	" 26
Phelps & Sanger	Cleveland, Ohio	" 120

SQUARE BAR IRON.

Weight of a Running Foot, in Pounds.

Thick. Inch's	Wt. per foot. lbs.	Thick. Inch's	Wt. per foot. lbs.	Thick. Inch's	Wt. per foot. lbs.	Thick. Inch's	Wt. per foot. lbs.
1/16	.0131	11/16	3.80	2 1/8	15.15	4 1/8	57.20
1/8	.0525	1/8	4.25	1/4	17.	1/4	60.75
3/16	.1182	3/16	4.73	3/8	18.5	3/8	4.55
1/4	.2103	1/4	5.25	1/2	20.5	1/2	68.
5/16	.327	5/16	5.78	5/8	23.1	5/8	72.
3/8	.4735	3/8	6.35	3/4	25.2	3/4	75.65
7/16	.6445	7/16	6.95	7/8	27.5	7/8	79.80
1/2	.84	1/2	7.55	3	30.05	5	83.8
9/16	1.063	9/16	8.2	1/8	32.75	1/8	88.25
5/8	1.314	5/8	8.85	1/4	35.5	1/4	92.5
11/16	1.59	11/16	9.57	3/8	38.25	3/8	97 15
3/4	1.891	3/4	10.30	1/2	41.15	1/2	1 1.
13/16	2 221	13/16	11.05	5/8	44.15	5/8	105.8
7/8	2.575	7/8	11.83	3/4	47.20	3/4	110.5
15/16	2.95	15/16	12.62	7/8	50.25	7/8	115.15
1	3.35	2	13.4	4	53.75	6	120.25

For STEEL multiply tabular number above (for size), by 1.01.

Hosted by Google

ESTABLISHED 1850.

RITCHIE & SON,

(Late H. Ritchie & Co. & S. C. Thomson & Co.)

MANUFACTURERS OF

Patent Padlocks

For Railroads, Stores, Safes, &c.

NO. 15 RAILROAD AVENUE, NEWARK, N. J.

F. O. NORTON,

MANUFACTURER OF

Rosendale Cement

PROPRIETOR OF THE

High Falls Cement Works and Binnewater Cement Works.

OFFICE, NO. 90 BROADWAY, NEW YORK.

J. BOORMAN JOHNSTON, SPECIAL PARTNER.

MARSHALL LEFFERTS, Jr.

OFFICE AND WAREROOMS,

No. 90 Beekman St., New York.

MANUFACTURER OF

AMERICAN GALVANIZED SHEET IRON.

ALSO, DEALER IN

BEST BLOOM, CHARCOAL AND REFINED SHEET IRON,

TELEGRAPH AND MERCHANT WIRE, NAILS, SPIKES, ETC.

Galvanizing Works, 54, 56, 58 Cannon St., N.Y.

ALL ORDERS PROMPTLY ATTENDED TO.

CORRUGATED IRON FOR ROOFING.

Hosted by Google

Brass Founders & Finishers.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116
Du Plaine & Reeves.....Philadelphia, Pa..... " 102
G. W. W. Stevens & Co.....New York..... " 8

Brass Padlocks.

Romer & Co.....Newark, N. J.....See Page 204
Ritchie & Son..... " " ..... " 44

Brass Tubing.

Ansonia Brass & Copper Co.....New York.....See Page 122
Crane Bros. Manufacturing Co..... .....Chicago, Ill..... " 230

Brass Wire.

Ansonia Brass & Copper Co.....New York.....See Page 122

Brick.

Hall & Sons.....Buffalo, N. Y.....See Page 254

Bridge and Roof Bolts.

Lewis Oliver & Phillips ; H. B. Newhall, Ag't New York.....See Page 166
Phillipsburg Manufacturing Co..... " " ..... " 22
See also, Bridge Irons.

Bridge Builders.

Phillipsburg Manufacturing Co.....New York.....See Page 22
Snyder Brothers.....Williamsport, Pa..... " 46
The McNairy & Claflen Manufacturing Co.....Cleveland, Ohio..... " 42

Bridge Castings.

The Atlas Works.....Pittsburgh, Pa.....See Page 172

Bridge Irons.

Greene & Randolph.....New York..... .....See Page 51
Hoopes & Townsend.....Philadelphia, Pa..... " 28
Jones & Laughlins.....Pittsburgh, Pa..... " 32
Phillipsburg Manufacturing Co.....New York..... " 22
Pittsburgh Bolt Co.....Pittsburgh, Pa..... " 118
Reese, Graff & Woods..... " " ..... " 68

Bridges.

Phillipsburg Manufacturing Co.....New York.....See Page 22
The McNairy & Claflen Manufacturing Co.....Cleveland Ohio..... " 42

Brokers.

Charles W. Matthews.....Philadelphia, Pa.....See Page 3

ROUND BAR IRON.

Weight of a Running Foot, in Pounds.

Diam. Incl's	Wt. per foot. lbs.	Diam. Incl's	Wt. per foot. lbs.	Diam. Incl's	Wt. per foot. lbs.	Diam. Incl's	Wt. per foot. lbs.
1/16	.01	11 1/16	2.975	2 1/8	11.9	4 1/8	44.85
1/8	.0411	1/8	3.338	1/4	13.3	1/4	47.54
3/16	.0925	3/16	3.725	3/8	14.75	3/8	50.33
1/4	.1651	1/4	4.12	1/2	16.41	1/2	53.32
5/16	.2573	5/16	4.545	5/8	18.1	5/8	56.34
3/8	.371	3/8	5.	3/4	19.85	3/4	59.44
7/16	.505	7/16	5.455	7/8	21.5	7/8	62.62
1/2	.657	1/2	5.945	3	23.7	5	65.88
9/16	.835	9/16	6.445	1/8	25.55	1/8	69.23
5/8	1.031	5/8	6.975	1/4	27.81	1/4	72.65
11/16	1.235	11/16	7.52	3/8	29.85	3/8	76.18
3/4	1.475	3/4	8.05	1/2	32.25	1/2	79.75
13/16	1.74	13/16	8.65	5/8	34.45	5/8	83.45
7/8	2.015	7/8	9.25	3/4	37.1	3/4	87.20
15/16	2.317	15/16	9.9	7/8	39.5	7/8	91.05
1	2.625	2	10.55	4	41.95	6	95.

For STEEL multiply tabular number above (for size), by 1.01.

Hosted by Google

M. A. BUELL,

CLEVELAND, OHIO,

MANUFACTURER AND DEALER IN

TELEGRAPH

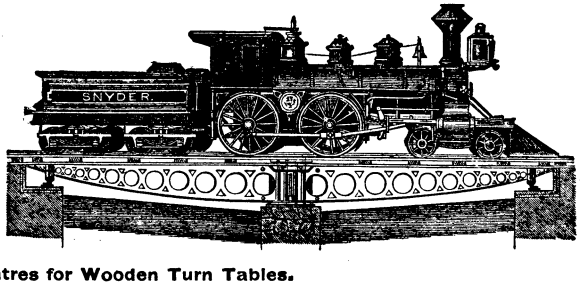
INSTRUMENTS and SUPPLIES.

Instruments, Learner's Instruments,
Batteries, Electric Alarms,
Chemicals, Apparatus,
Materials, Tools.

HOTEL ANNUNCIATORS.

☞ *SEND FOR A CATALOGUE.*

KELLY'S PATENT TURN TABLES.



Centres for Wooden Turn Tables.

PIVOT and SELF-CLOSING CANAL BRIDGES,

Saw Mill Machinery,
Fittings for Oil Tank Cars,
Steam Engines, Boilers, &c.

MANUFACTURED BY

SNYDER BROTHERS,

FOUNDERS and MACHINISTS

WILLIAMSPORT, - PENNSYLVANIA.

Hosted by Google

Bronze Castings.

Philadelphia Smelting Co.....Philadelphia, Pa.....See Page 134

Bronze Door Knobs.

Romer & Co.....Newark, N. J.....See Page 204

Bronze Door Trimmings.

Romer & Co.....Newark, N. J.....See Page 204

Brushes for Tubes.

Vose, Dinsmore & Co.....New York.....See Page 60

Builders' Hardware.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246
England & Bindley.....Pittsburgh, Pa..... " 162
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Sidney Shepard & Co.....Buffalo, N. Y..... " 196

Building Materials.

H. W. Johns.....New York.....See Page 224

Bunting.

De Grauw, Aymar & Co.....New York.....See Page 112

Burglar Alarms.

Geo. H. Bliss & Co.....Chicaco, Ill.....See Page 164

Butts.

England & Bindley.....Pittsburgh, Pa.....See Page 162
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Hermann Boker & Co.....New York.....See Pages 152, 154
Pratt & Co.....Buffalo, N. Y.....See Page 132
Wm. Green & Co.....Wilmington, Del..... " 248

HOOP AND SCROLL IRON.

Number of Feet in a Bundle of 5 Pounds.

Hoop Iron.

Size, Width.	Thick.	Feet in Bundle.
5/8 Inches.....	No. 21	815
3/4 "	" 20	630
7/8 "	" 19	450
1 "	" 18	360
1 1/8 "	" 17	278
1 1/4 "	" 16	217
1 1/2 "	" 15	160
1 3/4 "	" 15	139
2 "	" 14	110

Scroll Iron.

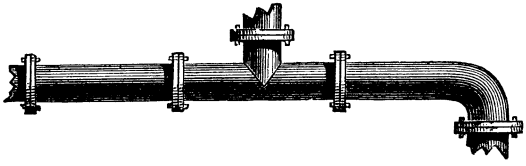
Size, Width.	Thick.	Feet in Bundle.
1/2 Inches.....	No. 10	240
5/8 "	" 16	430
5/8 "	" 14	347
5/8 "	" 10	190
3/4 "	" 16	360
3/4 "	" 14	290
3/4 "	" 12	208
3/4 "	" 10	160
7/8 "	" 16	310
7/8 "	" 14	219
7/8 "	" 12	175
1 "	" 16	270
1 "	" 14	216
1 "	" 12	152

WEIGHT OF TIRE IRON PER SET OF 54 FEET.

Size.	Pounds.
1 by 3/16	34
1 " 1/4	45
1 " 5/16	56
1 " 3/8	68
1 1/8 " 1/4	50
1 1/8 " 5/16	63
1 1/8 " 3/8	75
1 1/8 " 7/16	88
1 1/8 " 1/2	101
1 1/4 " 1/4	56
1 1/4 " 5/16	70
1 1/4 " 3/8	85
1 1/4 " 7/16	99
1 1/4 " 1/2	113

Size.	Pounds.
1 3/8 by 3/8	93
1 3/8 " 1/2	124
1 1/2 " 3/8	101
1 1/2 " 1/2	135
1 1/2 " 5/8	169
1 5/8 " 1/2	148
1 5/8 " 5/8	183
1 3/4 " 1/2	158
1 3/4 " 5/8	197
1 3/4 " 3/4	236
2 " 1/2	180
2 " 5/8	225
2 " 3/4	270

Hosted by Google



CAST IRON FLANGE PIPES

BOTH FACED AND DRILLED AND PLAIN.

GAS and WATER PIPES,

AND CONNECTIONS FOR SAME.

Valves, Fire Hydrants, &c.

R. A. BRICK & CO.

NO. 112 LEONARD ST., NEW YORK.

JAMES E. GRANNISS. JOHN MERRY.

JOHN MERRY & CO.

West Side Galvanizing Works,

541, 543, 545 & 547 West 15th St.,

Office and Warehouse, No. 46 Cliff St., New York.

MANUFACTURERS OF

BEST BLOOM AND REFINED

AMERICAN GALVANIZED SHEET IRON,

CORRUGATED IRON FOR ROOFING,
GALVANIZED TELEGRAPH AND FENCE WIRE,
GALVANIZED AND TINNED NAILS,

ALL KINDS OF IRON WORK GALVANIZED OR TINNED TO ORDER.

Hosted by Google

Buyers of Old Metal.

Du Plaine & Reeves.....Philadelphia, Pa.....See Page 102
Hooks' Smelting Co..... " " ..... " 216

Cabinet Makers' Machinery.

C. B. Rogers & Co.....New York.....See Page 210
J. A. Fay & Co .....Cincinnati, Ohio..... " 206

Cabinet Woods.

Joseph Churchyard.....Buffalo, N. Y.....See Page 160

Cable Chain.

De Grauw, Aymar & Co..... .....New York.....See Page 112
Hermann Boker & Co..... " " .....See Pages 152, 154

Cables—Telegraph.

Bishop Gutta Percha Works..... .New York.....See Page 34
Charles T. Chester..... " " ..... " 212
Leclanche Battery Co..... " " ..... " 96

Callipers.

Wm. Sellers & Co..... .....Philadelphia, Pa.....See P ge 64

Canal Bridges—Self-Closing.

Snyder Brothers.....Williamsport, Pa.....See Page 46

CAST IRON FLANGE PIPES.

(Furnished by R. A. Brick & Co.)

Internal Diameter. Feet.	Usual Thickness. Inches.	Weight per foot. Pounds.	Length. Feet.	Usual Diameter: Flange-Inches.
2	⅜ scant	8 to 10	8½ or less	6
3	⅜ full	13 to 16	"	7½
4	½ scant	20 to 24	"	8½
5	½ full	25 to 30	"	9½
6	⅝ scant	33 to 39	"	11
8	⅝ full	48 to 55	"	13
10	¾ scant	65 to 75	"	15
12	¾ full	90 to 100	"	18

CAST IRON COLUMNS.

Weight that can be borne with Safety by Cast-Iron Columns in 1000 *Lbs.*

(Trenton Iron Works.)

Diam. in Ins.	Length of Column in Feet. 5	6	7	8	9	10	12	14	16	18	20
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
2	12.4	9.4	7.2	—	—	—	—	—	—	—	—
3	44	36	30	24	20	18	—	—	—	—	—
4	102	88	76	66	56	48	38	28	—	—	—
5	184	164	146	130	114	102	80	64	52	44	—
6	288	264	242	218	198	180	136	122	100	84	72
7	414	386	360	332	306	282	238	200	170	144	124
8	560	532	502	470	440	410	354	304	262	226	196
9	728	698	660	630	596	560	494	432	378	332	292
10	916	884	850	812	774	739	658	586	520	462	410
11	1126	1082	1056	1016	974	932	846	774	686	616	552
12	1354	1320	1281	1240	1196	1152	1056	966	878	796	720
13	—	1570	1530	1486	1440	1392	1292	1192	1094	1000	912
14	—	—	1798	1754	1706	1656	1550	1440	1332	1228	1130
15	—	—	2086	2040	1992	1940	1828	1712	1596	1482	1372

The above table is based upon the following conditions:—The column must be placed precisely perpendicular; both ends must be faced exactly at a right angle with the vertical axis, and the load must be evenly distributed over the whole face.

If both ends are rounded, the weight should be reduced to one-third of the above; if one end is rounded, two-thirds should be allowed.

Hosted by Google

JOHN A. GRISWOLD & CO.,

PROPRIETORS OF THE

Rensselaer Iron Works, Bessemer Steel Works,

Fort Edward and Columbia Blast Furnaces.

MANUFACTURERS OF

RAILROAD, MERCHANT and SHIP IRON,

PIG IRON,

Bessemer Steel Rails,

Axles, Tyres, Shafting, &c.

TROY, NEW YORK.

For The Richardson Patent Perfect Safety Valve,

APPLICABLE TO

LOCOMOTIVES, STATIONARY and MARINE BOILERS.

Address, GEO. W. RICHARDSON & CO.,

39 CONGRESS STREET, TROY, N.Y.

For The Richardson Anti-Friction Slide Valve,

APPLICABLE TO

LOCOMOTIVES, STATIONARY and MARINE ENGINES,

AND

For The Richardson Relief Valve and Exhaust Nozzle,

APPLICABLE TO LOCOMOTIVES.

Address, RICHARDSON & CO.,

39 CONGRESS ST., TROY, N. Y.

Hosted by Google

Candies.

F. S. Pease.....Buffalo, N. Y.....See Page 100
L. G. Tillotson & Co.....New York..... " 94
P. H. Moffat.....Chicago, Ill..... " 190

Cap Screws.

Worcester Machine Screw Co.; H. B. Newhall, Agent.....New York.....See Page 166

Car Axles.

De Laney & Co.....Buffalo. N. Y.....See Page 98
Jonas S. Heartt & Co.....Troy, N. Y..... " 134
Pittsburgh Forge & Iron Co.....Pittsburgh, Pa..... " 174

WIRE—IRON, STEEL, COPPER, BRASS.

Weight of 100 *Feet in Pounds.*

(Taken from Haswell.)

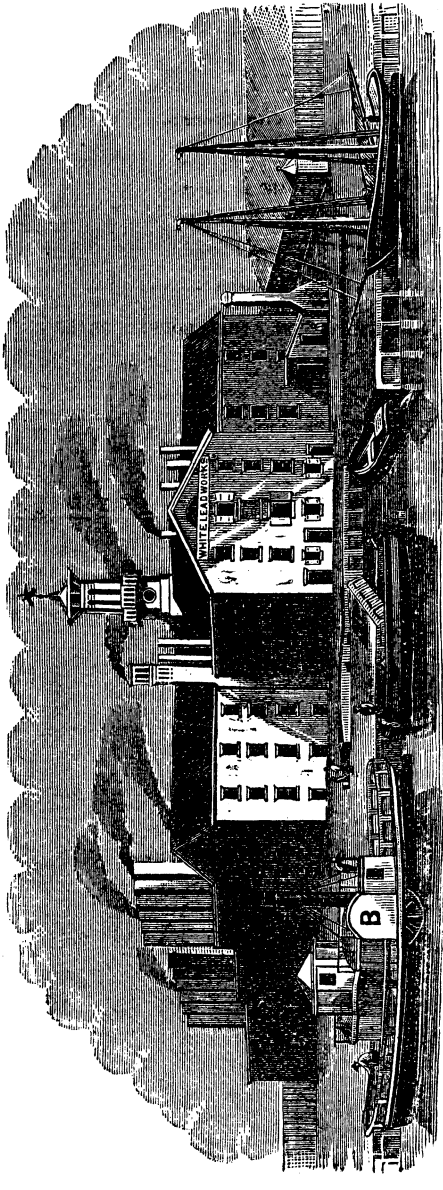
American Wire Gauge.					Birmingham Wire Gauge.				
No. of Gauge.	Wire—per Lineal Foot.				No. of Gauge.	Wire—per Lineal Foot.			
	Iron.	Steel.	Copper.	Brass.		Iron.	Steel.	Copper.	Brass.
0000	56.07	56.60	64.05	60 52	0000	54.62	55.13	62.39	58.93
000	44 47	44.89	50.79	47.99	000	47.86	48.32	54.67	51.64
00	35.26	35 6	40.28	38.07	00	38.27	38.63	43.71	41.28
0	27.97	28.23	31.94	30.18	0	30.63	30.92	34.99	33.05
1	22.18	22.39	25.33	23.93	1	23.85	24.07	27.24	25.73
2	17.59	17.75	20 09	18.98	2	21.37	21.57	24.41	23.06
3	13.95	14.08	15.93	15.05	3	17 78	17.94	20.3	19.18
4	11.06	11.17	12 63	11.94	4	15.01	15.15	17.15	16.19
5	8.772	8.855	10.02	9 467	5	12.82	12 95	14.65	13.84
6	6.957	7.022	7.946	7.507	6	10.92	11.02	12.47	11.78
7	5.552	5. 68	6.301	5.954	7	8.586	8.667	9.807	9.263
8	4.375	4.416	4. 98	4.722	8	7.214	7.283	8.241	7.783
9	3.47	3.503	3.964	3.744	9	5.805	5.859	6.63	6.262
10	2.751	2.777	3.143	2 969	10	4.758	4.803	5.435	5.133
11	2.182	2.203	2.492	2.355	11	3.816	3.852	4.359	4 117
12	1.730	1 747	1.977	1.867	12	3.148	3.178	3.596	3.397
13	1.372	1.385	1.567	1.481	13	2.392	2.414	2.732	2.58
14	1.089	1.099	1.243	1.174	14	1.826	1 843	2.085	1.969
15	.8631	.8712	.9859	.9315	15	1.374	1.387	1.569	1.482
16	.6845	.6909	.7819	.7387	16	1.119	1.13	1.279	1.208
17	.5427	.5478	.6 99	.5857	17	.8915	.9	1.018	.9618
18	.4304	.4344	.4916	.4645	18	.6363	.6423	.7268	.6864
19	.3413	.3445	.3899	.3683	19	.4675	.472	.534	.5043
20	.2708	.2734	.3094	.292	20	.3246	.3277	.3709	.3502
21	.2147	.2167	.2452	.2317	21	.2714	.274	.31	.2929
22	.1703	.1719	.1945	.1838	22	.2079	.2098	.2373	.2241
23	.135	.1363	.1542	.1457	23	.1656	.1672	.1892	.1788
24	.1071	.1081	.1223	.1155	24	.1283	.1295	.1465	.1384
25	.0849	.0857	.097	.0916	25	.106	.107	.1211	.1144
26	.0673	.068	.0769	.0727	26	.0859	.0867	.0981	.0926
27	.0534	.0539	.061	.0576	27	.0678	.0685	.0775	.0732
28	.0423	.0427	.0484	.0457	28	.0539	.0524	.0593	.056
29	.0336	.0339	.0383	.0362	29	.0448	.0452	.0511	.0483
30	.0266	.0269	.0304	.0287	30	.0382	.0385	.0436	.0412
31	.0211	.0213	.0241	.0228	31	.0265	.0267	.0303	.0286
32	.0167	.0169	.0191	.0181	32	.0215	.0217	.0245	.0231
33	.0133	.0134	.0152	.0143	33	.017	.0171	.0194	.0183
34	.0105	.0106	.0120	.0114	34	.013	.0131	.0148	.014
35	.0083	.0084	.0095	.009	35	.0066	.0067	.0076	.0071
36	.0066	.0067	.0076	.0071	36	.0042	.0043	.0048	.0046

Hosted by Google

ESTABLISHED 1782.

WETHERILL & BROTHER

MANUFACTURERS OF



WHITE LEAD, RED LEAD, LITHARGE AND ORANGE MINERAL.

The present proprietors succeed Wm. Wetherill, successor to John P. & Wm. Wetherill, sons of Sam'l Wetherill, the Original Manufacturer of the above articles in the United States.

Office, No. 41 North Front St. PHILADELPHIA. *Factory, 30th St. below Chestnut.*

Hosted by Google

Car and Journal Bearings.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116
Du Plaine & Reeves.....Philadelphia, Pa..... " 102
Hooks Smelting Co..... " " ..... " 216
G. W. W. Stevens & Co.....New York..... " 8

Car Bits.

Champlin & Rogers.....Chicago, Ill.....See Page 192

Car Boxes.

Isaac U. Coles.....New York..... .See Page 20

Car Box Borers.

Buffalo Machinery Agency.....Buffalo, N. Y.....See Page 160
Vose, Dinsmore & Co.....New York..... " 60

Car Brasses.

Philadelphia Smelting Co.....Philadelphia, Pa.....See Page 134

Car Builders.

Erie Car Works.....Erie, Pa.....See Page 188
The McNairy & Claflen Manufacturing Co.....Cleveland, Ohio..... " 42
Wason Manufacturing Co.....Springfield, Mass..... " 146

Car Colors.

C. E. Hecht.....Easton, Pa.....See Page 158
Edward Smith & Co.....New York..... " 218
Jno. W. Masury & Son..... " " ..... " 214

ACRES REQUIRED FOR DIFFERENT WIDTHS OF ROADWAY.

(Condensed from Trautwine.)

Width of Road in Feet.	Acres per Mile.	Acres per 100 Ft.	Width of Road in Feet.	Acres per Mile.	Acres per 100 Ft.
1	.121	.002	48	5.82	.11
2	.242	.005	49½	6.	.114
3	.364	.007	50	6.06	.115
4	.485	.009	52	6.3	.119
5	.606	.011	54	6.55	.124
6	.727	.014	56	6.79	.129
7	.848	.016	57¾	7.	.133
8	.970	.018	58	7.03	.133
¼	1.	.019	60	7.27	.138
9	1.09	.021	62	7.52	.142
10	1.21	.023	64	7.76	.147
12	1.46	.028	66	8.	.151
14	1.70	.032	68	8.24	.156
16	1.94	.037	70	8.48	.161
½	2.	.038	72	8.73	.165
18	2.18	.041	74	8.97	.7
20	2.42	.046	¼	9.	.17
22	2.67	.051	76	9.21	.174
24	2.91	.055	78	9.45	.179
¾	3.	.057	80	9.7	.184
26	3.15	.06	82	9.94	.188
28	3.39	.064	½	10.	.189
30	3.64	.069	84	10.2	.193
32	3.88	.073	86	10.4	.197
34	4.12	.078	88	10.7	.202
36	4.36	.083	90	10.9	.207
38	4.61	.087	¾	11.	.209
40	4.85	.092	92	11.2	.211
41¼	5.	.094	94	11.4	.216
42	5.09	.096	96	11.6	.22
44	5.33	.101	98	11.9	.225
46	5.58	.106	100	12.1	.23

Hosted by Google

GREENE & RANDOLPH,

Nos. 40 & 42 BROADWAY,

(P. O. BOX 5192.)

NEW YORK.

RAILWAY SUPPLIES,

OF ALL KINDS.

English and American Iron and Steel Rails,

LOCOMOTIVES,
PASSENGER CARS,
FREIGHT CARS,

Steel and Rubber Springs,

WHEELS, AXLES,
CAR IRONS, BRIDGE IRONS,
BOLTS, NUTS,
RODS, SPIKES,
FISH PLATES,

Track Supplies, Contractors' Material,

&c, &c., &c., &c

Everything Necessary to Maintain and Operate Railways.

Hosted by Google

Car Door Catches.

Posts & Kalkman.....New York.....See Page 266

Car Door Locks.

Romer & Co.....Newark, N. J.....See Page 204

Car Equipments.

Du Plaine & Reeves.....Philadelphia, Pa.....See Page 102

Car Glass.

D. R. Hobart & Co.....New York.....See Page 126
Leffingwell & Co .....Cleveland, Ohio..... " 190
L. G. Tillotson & Co. .....New York..... " 94

HOLLOW CAST IRON COLUMNS (CYLINDRICAL).

Breaking Weight in Tons.

This is a *comparative* table of Breaking Weights; the columns headed **H.** as given by Hurst, and the columns headed **T.** as given by Trautwine. Trautwine's figures are qualified by many explanations and remarks on the different qualities of iron and the various tests and experiments on which the rules, by which the following figures were made, are based. The table will serve to show the great difference of opinion, and results, which skilled men and minds will entertain on the same subject.

Ext'rn'l Diam.	Thick. of Metal	Length of Column in Feet.									
		8 Feet.		10 Feet.		12 Feet.		14 Feet.		16 Feet.	
		H.	T.	H.	T.	H.	T.	H.	T.	H.	T.
3	1/2	40	50	32	—	23	—	18	—	14	—
3	5/8	47	—	35	—	26	—	20	—	16	—
3	3/4	54	—	38	—	28	—	22	—	17	—
3 1/2	1/2	59	72	51	55	36	—	27	—	23	—
3 1/2	5/8	71	—	53	—	42	—	32	—	25	—
3 1/2	3/4	81	92	62	68	44	—	35	—	26	—
4	1/2	81	98	61	76	47	59	36	—	34	—
4	5/8	92	—	73	—	56	—	44	—	39	—
4	3/4	113	129	85	100	65	76	48	—	38	—
4	1	139	—	104	—	80	—	64	—	48	—
4 1/2	1/2	106	127	81	101	65	81	50	—	44	—
4 1/2	5/8	128	—	99	—	77	—	61	—	55	—
4 1/2	3/4	149	169	115	134	89	108	72	—	60	—
4 1/2	1	185	—	143	—	111	—	88	—	71	—
5	1/2	133	157	104	126	83	104	67	—	54	—
5	5/8	161	—	127	—	91	—	81	—	70	—
5	3/4	188	214	148	171	117	140	90	—	77	—
5	1	236	—	186	—	148	—	119	—	96	—
5 1/2	1/2	153	190	129	155	105	129	85	108	70	—
5 1/2	5/8	187	—	157	—	128	—	104	—	88	—
5 1/2	3/4	218	261	184	212	149	175	121	147	102	—
5 1/2	1	276	—	232	—	189	—	153	—	127	—
6	1/2	190	224	155	185	127	155	95	131	87	—
6	5/8	232	—	190	—	156	—	128	—	106	—
6	3/4	272	311	223	256	183	213	150	180	125	—
6	1	345	—	283	—	232	—	191	—	159	—
6 1/2	5/8	269	—	224	—	187	—	152	—	130	—
6 1/2	3/4	316	363	263	303	219	255	178	217	153	—
6 1/2	1	403	—	336	—	280	—	228	—	196	—
7	5/8	307	—	260	—	219	—	185	—	156	—
7	3/4	361	416	306	351	258	298	217	255	184	221
7	1	462	522	391	438	330	370	278	316	236	272
8	1	583	667	507	571	438	491	377	425	325	370
9	1	705	818	627	713	553	616	481	545	423	480

Hosted by Google

IMPROVED AIR BRAKE,

MANUFACTURED BY THE

Ward Air Brake Co.

OF KALAMAZOO, MICHIGAN.

CHARTERED BY THE STATE OF MICHIGAN, FEBRUARY, 1872.

A trial of the *Ward Air Brake* for more than one year has fully demonstrated it to be the CHEAPEST, SIMPLEST and most effective Air Brake now in use. It has much fewer parts, a more speedy release, and costs nearly one-half less than other Air Brakes. Has been in constant use for over one year, and is most highly recommended by prominent railroad men.

A trial train equipped upon any road, to be paid for only when found satisfactory. ☞ Full particulars and terms furnished upon application.

L. B. KENDALL, *President.* **T. S. COBB;** *Sec. and Treas.*

LUCIUS HART & Co

Importers & Dealers in

PIG TIN. / ANTIMONY. / PIG LEAD. / SPELTER. / INGOT COPPER. / BAR TIN. / BAR LEAD. / BISMUTH. / NICKEL. / BABBITT METAL / SOLDER, &c.

8 & 10 BURLING SLIP,

CHAS. FANNING.
LUCIUS HART.

NEW YORK.

J. D. WEST & CO.

40 Cortlandt Street, - New York.

WEST'S IMPROVED AND OTHER

PUMPS,

WITH PIPE, HOSE, &c.

WEST'S COPPER, OTIS' AND OTHER

Lightning Rods,

WEATHER VANES, CRESTINGS, &c.

Hosted by Google

Car Hassocks.

Geo. Drake Smith.....Philadelphia, Pa.....See Page 246
New York Ottoman & Hassock Co.....New York..... " 236

Car Hooks.

Vose, Dinsmore & Co.....New York.....See Page 60

Car Irons.

Greene & Randolph.....New York.....See Page 54
Hoopes & Townsend.....Philadelphia, Pa..... " 28

Car Linings.

E S. Lunt.....New York.....See Page 84
L. G. Tillotson & Co..... " " ..... " 94

Car Makers' Machinery.

C. B. Rogers & Co.....New York.....See Page 210
J. A. Fay & Co.....Cincinnati, Ohio..... " 2 6
Richards, London & Kelley.....Philadelphia, Pa..... " 66

Car Packing.

Isaac U. Coles.....New York.....See Page 20

HEAVY WROUGHT IRON ARTESIAN TUBES.

Inside Diameter.		Weight per foot, lbs.	Inside Diameter.		Weight per foot, lbs.
1½	.....	2.694	4½	.....	12.492
2	.....	3.667	5	.....	14.564
2½	.....	5.773	6	.....	18.767
3	.....	7.547	7	.....	23.410
3½	.....	9.055	8	.....	28.348
4	.....	10.728			

CAPACITY OF CISTERN, IN GALLONS, FOR EACH FOOT IN DEPTH.

Diam. in feet.	Gallons.	Diam. in feet.	Gallons.	Diam. in feet.	Gallons.	Diam. in feet.	Gallons.
2.	23.4	5.5	177.7	9.	475.87	15.	1,321.9
2.5	36.6	6.	211.5	9.5	553.67	20.	2,350.1
3.	43.0	6.5	248.22	10.	587.5	25.	3,570.7
3.5	71.50	7.	287.79	11.	710.9	30.	5,287.7
4.	94.30	7.5	330.48	12.	845.	35.	7,189.
4.5	119.	8.	376.	13.	992.9	40.	9.367.2
5.	147.	8.5	424.44	14.	1151.5	45.	11,893.2

CEMENT TO RESIST FIRE AND WATER, AND HARDEN QUICKLY.

Two parts finely sifted unoxodized iron filiugs.
Ono part, perfectly dry, finely powdered loam.
Knead the mixture with strong vinegar into a homogeneous plastic mass, to be used as soon as made.

CEMENT FOR STOPPING JOINTS, ETC.

White lead in oil, mixed with enough white sand to make a stiff paste. This grows hard by exposure, aud resists heat, cold and water.

Hosted by Google

CRESCENT TUBE WORKS.

EVANS, DALZELL & CO.

MANUFACTURERS OF

WROUGHT

IRON PIPE.

No. 165 First Avenue,

PITTSBURGH, PA.

Hosted by Google

Car Plushes, &c.

E. S. Lunt.....New York.....See Page 84
L. G. Tillotson & Co..... " " ..... " 94
Vose, Dinsmore & Co..... " " ..... " 60

Carpenters' Tools.

England & Bindley.....Pittsburgh, Pa.....See Page 162
Geo. Worthington & Co..... .....Cleveland, Ohio..... ..... " 100
Hermann Boker & Co.....New York.....See Pages 152, 154

Carriage Builders' Machinery.

C. B. Rogers & Co.....New York.....See Page 210

Carriage Bolts.

Lewis Oliver & Phillips; H. B. Newhall, Agt...New York.....See Page 166

Carriage Hardware, Wheels, Spokes, &c.

Wm. Green & Co.....Wilmington, Del.....See Page 248

WEIGHTS AND DIMENSIONS OF GAS PIPES.

Inside Diameter in inches.	Outside Diameter in inches.	Weight per foot in pounds.	Inside Diameter in inches.	Outside Diameter in inches.	Weight per foot. in pounds.
1/8	0.40	0.24	3	3.5	7.54
1/4	0.54	0.42	3 1/2	4.0	9.05
3/8	0.67	0.56	4	4.5	10.72
1/2	0.84	0.85	4 1/2	5.0	12.49
3/4	1.05	1.12	5	5.56	14.56
1	1.31	1.67	6	6.62	18.77
1 1/4	1.66	2.25	7	7.62	23.41
1 1/2	1.95	2.69	8	8.62	28.35
2	2.37	3.66	9	9.68	34.07
2 1/2	2.87	5.77	10	10.75	40.64

WEIGHTS AND DIMENSIONS OF LAP-WELDED IRON BOILER FLUES.

Outside Diameter	Thickness W. G.	Lbs. weight per foot.	Outside Diameter	Thickness W. G.	Lbs. weight per foot.
1 1/4	14	1.65	3 1/4	11	4.15
1 1/2	14	1.70	3 1/2	10	5.20
1 3/4	13	1.85	3 3/4	10	5.30
2	13	2.10	4	10	5.55
2 1/4	13	2.30	5	9	7.1
2 1/2	12	2.50	6	8	10.5
2 3/4	12	3.15	7	8	12.2
3	11	3.60			

LIGHT WROUGHT IRON ARTESIAN TUBE AND CASING FOR OIL WELLS

Standard Sizes.

Outside Diameter. Inches.	Inside Diameter. Inches.	Weight per Foot. Pounds.	Outside Diameter. Inches.	Inside Diameter. Inches.	Weight, per Foot. Pounds.
1 3/4	1 1/2	1.665	4 1/4	4	5.500
2 1/4	2	2.238	4 1/2	4 1/4	6.010
2 1/2	2 1/4	2.755	5	4 3/4	7.226
2 3/4	2 1/2	3.045	5 1/4	5	7.667
3	2 3/4	3.333	5 1/2	5 3/16	8.083
3 1/4	3	3.958	6	5 5/8	9.346
3 1/2	3 1/4	4.272	6 5/8	6 1/4	10.064
3 3/4	3 1/2	4.950	7	6 5/8	12.435
4	3 3/4	5.320	8	7 5/8	15.109
			8 5/8	8 1/4	16.155

Hosted by Google

VOSE, DINSMORE & CO.

CAR SPRINGS,

RAILWAY SUPPLIES,

FRENCH STEEL,

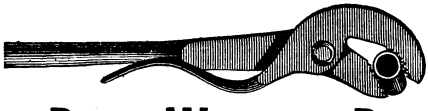
STEEL RAILS, TIRES, &c.

Principal Office, 32 Warren St., New York.

Branch Offices: { 52 Fifth Avenue, Chicago.
720 North Second Street, St. Louis.

BARWICK WRENCH COMPANY,

Proprietors and Sole



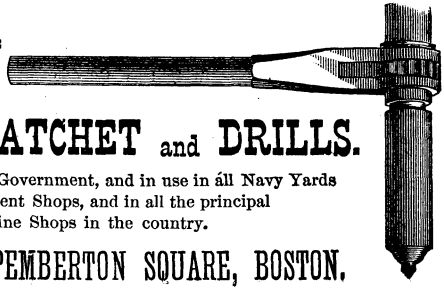
Manufacturers of the

Barwick Patent Wrench AND Pipe-Tongs.

PIPE TONGS, WRENCH AND PLIERS COMBINED IN ONE.
☞ All Steel, Six Sizes, Instantly Applied, Convenient and Reliable. ☜

ALSO,
MANUFACTURERS OF THE

CELEBRATED



PACKER RATCHET and DRILLS.

Adopted by the U. S. Government, and in use in all Navy Yards and Government Shops, and in all the principal Machine Shops in the country.

OFFICE, No. 5 PEMBERTON SQUARE, BOSTON.

Hosted by Google

Cars.

Chas. W. Matthews ..... Philadelphia, Pa. ..... See Page 38
Erie Car Works ..... Erie, Pa. ..... " 188
Miller & Smith ..... New York ..... " 112
O. W. Child ..... " " ..... " 262
Skinner & Gifford Mfg. Co. ..... Dunkirk, N. Y. ..... " 140
The McNairy & Claflen Mfg. Co. ..... Cleveland, Ohio ..... " 42
Wason Mfg. Co. ..... Springfield, Mass. ..... " 146
See also, Car Builders.

Car Springs.

Chicago Spring Works ..... Chicago, Ill. ..... See Page 200
Goodyears I. R. G. Mfg. Co. ..... New York ..... " 252
New York Rubber Co. ..... " " ..... " 260
Posts & Kalkman ..... " " ..... " 266
Vose, Dinsmore & Co. ..... " " ..... " 60

Car Stoves.

L. G. Tillotson & Co. ..... New York ..... See Page 94

Car Trimmings.

L. G. Tillotson & Co. ..... New York ..... See Page 94

Car Varnishes.

Edward Smith & Co. ..... New York ..... See Page 218
Valentine & Co. ..... " " ..... " 198

Car Wheel Borers.

Wm. Sellers & Co. ..... Philadelphia, Pa. ..... See Page 64

Car Wheels.

See Wheels.

RUBBER CAR SPRINGS,

To resist actual compression and bulging, should be used in layers, with intervening division plates; if used in bulk, should have retaining rings to preven bursting.

The duration of spring depends, of course, on its quality. Pure rubber is of little use; it must be vulcanized. It is adulterated with plumbago, though in best springs as much as 40 per cent. foreign substances are used—principally sulphide of lead and soapstone.

WEIGHT OF RUBBER CAR SPRINGS.

Diameter in Inches.	Height in Inches.	Diameter of Hole.	Weight.
4	4	1	3 lbs.
4½	4½	1	4 lbs. 5 oz.
5	5	1	5½ "
5½	5½	1	7 " 10 oz.
6	6	1	9¾ "
6½	6½	1	12 " 5 oz.
7	7	1	15¾ "
7½	7½	1	19½ "
8	8	1	23½ "
8½	8½	1	27¾ "
9	9	1	32¼ "
10	10	1	45½ "
11	11	1	59 "

Hosted by Google

BOLEN, CRANE & CO.

Machinists AND Tool Builders

23, 25, 27, 29 PLANE ST., NEWARK, N. J.

MANUFACTURERS OF

Railroad Tools and Equipments

FOR MACHINE SHOPS, SMITH and BOILER SHOPS.

PLANERS, DRILLS, SHAPERS, LATHES,
BOLT CUTTERS and NUT TAPPING MACHINES,
SLOTTING, KEYSEATING, BORING and GEAR CUTTING MACHINES,
AXLE LATHES, CENTERING MACHINES, CRANK PIN PRESSES,
DRIVING WHEEL LATHES, HYDRAULIC WHEEL PRESSES,
PUNCHES, SHEARS, BENDING ROLLS, &c.

STEAM HAMMERS OF IMPROVED CONSTRUCTION.

WE MANUFACTURE A FIRST-CLASS
DIRECT ACTING STEAM PUMP.
ALSO **STEAM ENGINES, SHAFTING and PULLEYS.**

New York Leather Hose Manufacturing Co.

DARROW, TURNER & CO.

35 SPRUCE ST.,

NEW YORK.

FIRE ENGINE HOSE MADE FROM THE BEST **OAK TANNED LEATHER,**
and of the best workmanship, furnished at short notice. ALSO,

Fire Buckets, Couplings, Hose Pipes, Suction Hose, &c.
AND **Fire Department Supplies Generally.**

All kinds of Repairing to Leather Hose Done at Short Notice.
Old Hose taken in Exchange for New.

All kinds **LEATHER BELTING** at Lowest Prices.

Hosted by Google

Castings.

Bowlers, Maher & Brayton.....Cleveland, Ohio.....See Page 42
Skinner & Gifford Mfg. Co.....Dunkirk, N. Y..... " 140
The Atlas Works.....Pittsburgh, Pa..... " 172

Cast Iron Sinks.

R. L. Howard & Son.....Buffalo, N. Y.....See Page 40

SHEET AND BAR BRASS.

Weight in Pounds.

Thickness, or Diameter, or Side; Inches.	Sheets per Square Foot.	Square Bars 1 Foot Long.	Round Bars 1 Foot Long.	Thickness, or Diameter, or Side; Inches.	Sheets per Square Foot.	Square Bars 1 Foot Long.	Round Bars 1 Foot Long.
1/16	2.7	.015	.011	11/16	45.95	4.08	3.20
1/8	5.41	.055	.045	1/8	48.69	4.55	3.57
3/16	8.12	.125	.1	3/16	51.4	5.08	3.97
1/4	10.76	.225	.175	1/4	54.18	5.65	4.41
5/16	13.48	.350	.275	5/16	56.85	6.22	4.86
3/8	16.25	.51	.395	3/8	59.55	6.81	5.35
7/16	19.	.69	.54	7/16	62.25	7.45	5.85
1/2	21.65	.905	.71	1/2	65.	8.13	6.37
9/16	24.3	1.15	.9	9/16	67.75	8.83	6.92
5/8	27.12	1.4	1.1	5/8	70.35	9.55	7.48
11/16	29.77	1.72	1.35	11/16	73.	10.27	8.05
3/4	32.46	2.05	1.6	3/4	75.86	11.	8.65
13/16	35.18	2.4	1.85	13/16	78.55	11.82	9.29
7/8	37.85	2.75	2.15	7/8	81.25	12.68	9.95
15/16	40.55	3.15	2.48	15/16	84.	13.5	10.58
1	43.29	3.65	2.85	2	86.75	14.35	11.25

ALLOYS.

Alloys.	Zinc.	Tin.	Copper.	Antimony.	Lead.	Bismuth
Babbitt meta	.....	10	1	1	.....	.....
Bell metal	.....	5	16	.....	.....	.....
Brass engine bearings	1/4	13	112	.....	.....	.....
" (tough) for engine work,	15	15	1 0	.....	.....	.....
" " for heavy bearings	5	25	160	.....	.....	.....
" , yellow for turning	1	.....	2	.....	.....	.....
" for locomotive bearings	1	7	64	.....	.....	.....
" for straps and glands	1	16	130	.....	.....	.....
Flanges to stand brazing	1	.....	32	.....	1	.....
Metal to expand in cooling	.....	.....	.....	2	9	1
Muntz's sheathing	40	.....	60	.....	.....	.....
Pewter	.....	100	.....	17	.....	.....
Spelter	1	.....	1	.....	.....	.....
Statuary bronze	5	2	90	.....	2	.....
Solders.						
For lead	.....	1	.....	.....	1 1/2	.....
" tin	.....	1	.....	.....	2	.....
" pewter	.....	2	.....	.....	1	.....
" brazing (soft)	3	1	4	.....	.....	.....
" " "	.....	2	.....	1	.....	.....
" " (hard)	1	.....	1	.....	.....	.....
" " (hardest)	1	.....	3	.....	.....	.....

Hosted by Google

ESTABLISHED 1848.

WM. SELLERS & CO.

1600 HAMILTON ST., PHILADELHIA.

Engineers and Machinists.

MANUFACTURERS OF

IRON AND STEEL

WORKING TOOLS

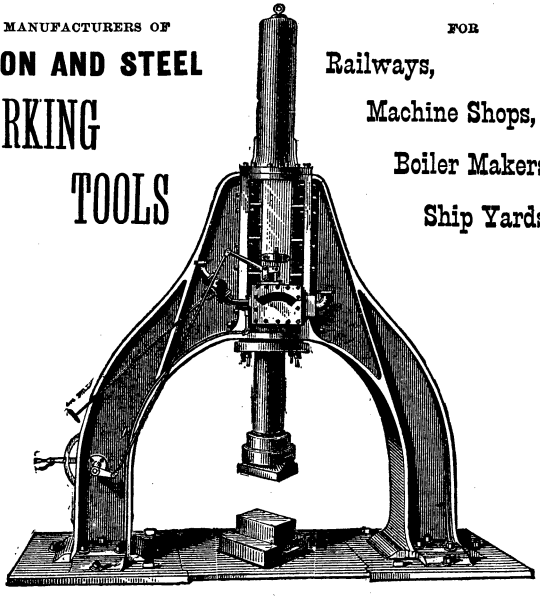
FOR

Railways,

Machine Shops,

Boiler Makers,

Ship Yards, &c.



Our Tools have been constructed with special reference to *economy* and *convenience of working.* Many of them are of novel and patented designs.

PIVOT BRIDGES and RAILWAY TURN TABLES.

MILL GEARING AND SHAFTING A SPECIALTY.

PATENTEES AND MANUFACTURERS OF

INJECTORS FOR FEEDING BOILERS.

☞Full descriptive specifications, photographs and prices sent on application.

Hosted by Google

Cast Steel.

Atlantic Steel Works.....New York.....See Page 212
Atwater, Wheeler & Co.....New Haven, Conn..... " 10
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Reese, Graff & Woods.....Pittsburgh, Pa..... " 68
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138
Tyng & Co.....New York..... " 260
Vose, Dinsmore & Co..... " " ..... " 60

Cement.

F. O. Norton.....New York..... .....See Page 44
H. W. Johns..... " " ..... " 224
Van Tuyl Manufacturing Co..... " " ..... " 242

Chain Links.

Hoopes & Townsend.... .....Philadelphia, Pa.....See Page 28

Chains.

De Grauw, Aymar & Co.....New York.....See Page 112
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Hermann Boker & Co.....New York.....See Pages 152, 154
T. B. Bickerton & Co..... Philadelphia, Pa.....See Page 138
Tyng & Co.....New York..... " 260
Vose, Dinsmore & Co.....New York..... " 60

Chains, Measuring.

F. Eckel.....New York.....See Page 76

Chasing Lathes.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

WEIGHT OF FLAT IRON.—4 PAGES.

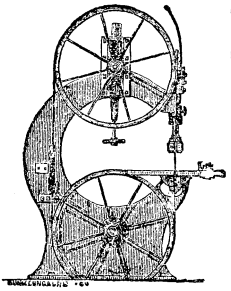
Weight of Running Foot in Pounds.

Width in Ins.	Thickness in Inches.						
	1/16	1/8	3/16	1/4	5/16	3/8
1	.21	.41	.62	.83	1.04	1.25
1/8	.23	.47	.7	.94	1.17	1.41
1/4	.26	.52	.78	1.04	1.3	1.56
3/8	.29	.57	.86	1.14	1.43	1.72
1/2	.31	.62	.94	1.25	1.56	1.87
5/8	.34	.68	1.01	1.35	1.69	2.03
3/4	.36	.73	1.09	1.46	1.82	2.19
7/8	.39	.78	1.17	1.56	1.95	2.34
2	.42	.83	1.25	1.67	2.08	2.5
1/8	.44	.88	1.33	1.77	2.21	2.65
1/4	.47	.94	1.4	1.87	2.34	2.81
3/8	.5	.99	1.48	1.98	2.47	2.97
1/2	.52	1.04	1.56	2.09	2.6	3.12
5/8	.55	1.09	1.64	2.19	2.73	3.28
3/4	.57	1.14	1.72	2.29	2.86	3.44
7/8	.6	1.2	1.8	2.4	2.99	3.59
3	.62	1.25	1.87	2.5	3.12	3.75
1/8	.65	1.3	1.95	2.6	3.26	3.91
1/4	.68	1.35	2.03	2.7	3.38	4.06
3/8	.7	1.4	2.11	2.81	3.52	4.22
1/2	.73	1.46	2.19	2.91	3.65	4.37
5/8	.76	1.51	2.27	3.02	3.78	4.53
3/4	.78	1.56	2.34	3.12	3.91	4.69
7/8	.81	1.61	2.42	3.23	4.03	4.84
4	.83	1.66	2.5	3.33	4.17	5.00
1/8	.86	1.72	2.58	3.44	4.3	5.16
1/4	.88	1.77	2.66	3.54	4.43	5.31
3/8	.91	1.82	2.73	3.64	4.56	5.47
1/2	.94	1.87	2.81	3.75	4.69	5.62
5/8	.96	1.93	2.89	3.85	4.82	5.78
3/4	.99	1.98	2.97	3.96	4.95	5.94
7/8	1.01	2.03	3.05	4.06	5.08	6.1
5	1.04	2.08	1.12	4.17	5.21	6.25
1/8	1.06	2.13	3.2	4.27	5.34	6.41
1/4	1.1	2.19	3.28	4.37	5.47	6.56

Hosted by Google

Wood Cutting Machinery,

FOR



Railway Car Building,

SHIP-BUILDING and BAND SAWING.

THE CELEBRATED FRENCH

"M. PERIN & CO."

Band Saw Blade,

ANY LENGTH AND WIDTH.

RICHARDS, LONDON & KELLEY,

ATLANTIC WORKS,

22d, Above ARCH,

SEND FOR CIRCULAR. **PHILADELPHIA, PA.**

Hosted by Google

Chemicals—Telegraph.

Leclanche Battery Co.....New York.....See Page 96
See also, Telegraph Materials.

Chilled Faced R. R. Frogs.

Bowlers, Maher & Brayton.....Cleveland, Ohio.....See Page 42

Chimes.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116

Chisels.

Hermann B ker & Co.....New York.....See Pages 152, 154
See also Carpenters' and Mechanics' Tools.

Chucks.

Champlin & Rogers.....Chicago, Ill.....See Page 192
D. Brewer & Co.....Philadelphia, Pa. ..... " 246

Church and School Bells.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116

Chute Nails.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Circular Saw Mills.

Erie City Iron Works.....Erie, Pa.....See Page 170

Circular Saws.

American Saw Co..... .....New York.....See Page 156
Buffalo Machinery Agency.....Buffalo, N. Y..... " 160
Erie City Iron Works.....Erie, Pa..... " 170

WEIGHT OF FLAT IRON.—Continued.

Weight of Running Foot in Pounds.

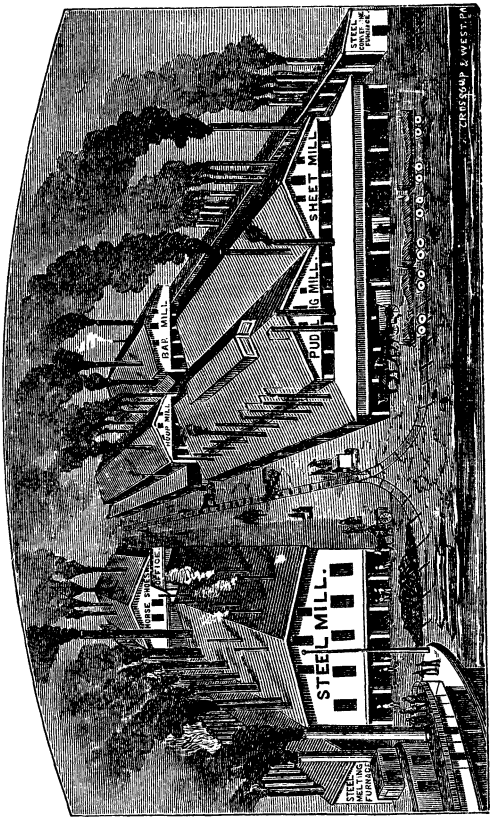
Width in Ins.	Thickness in Inches. 1/16	1/8	3/16	1/4	5/16	3/8
5 3/8	1.12	2.24	3.36	4.48	5.6	6.72
1/2	1.14	2.29	3.44	4.58	5.73	6.88
5/8	1.17	2.34	3.52	4.69	5.86	7.03
3/4	1.2	2.39	3.59	4.79	6.	7 19
7/8	1.22	2.45	3.67	4.9	6.12	7.34
6	1.25	2.5	3.75	5.	6.25	7.5
1/8	1.27	2.55	3.83	5.1	6.39	7.66
1/4	1.3	2.6	3.91	5.2	6.51	7.81
3/8	1.32	2.66	3.98	5.31	6.64	7.97
1/2	1.35	2.7	4.06	5.41	6.77	8.13
5/8	1.38	2.76	4.14	5.52	6.91	8.29
3/4	1.4	2.81	4.22	5.62	7.03	8.44
7/8	1.43	2.86	4.3	5.73	7.16	8.59
7	1.46	2.92	4.37	5.83	7.29	8.75
1/4	1.51	3.02	4.53	6.04	7.55	9.07
1/2	1.56	3.12	4.69	6.25	7.81	9.37
3/4	1.61	3.23	4.84	6.46	8.07	9.69
8	1.67	3.33	5.	6.67	8.33	10.
1/4	1.72	3.43	5.16	6.87	8.6	10.3
1/2	1.77	3.54	5.32	7.08	8.85	10.63
3/4	1.82	3.65	5.47	7.29	9.11	10.94
9	1.87	3.75	5.62	7.5	9.37	11.25
1/4	1.93	3.85	5.78	7.71	9.63	11.56
1/2	1.98	3.96	5.94	7.92	9.89	11.87
3/4	2.03	4.06	6.09	8.12	10.15	12.19
10	2.08	4.17	6.25	8.33	10.4	12.5
1/4	2.13	4.27	6.4	8.54	10.67	12.8
1/2	2.19	4.37	6.56	8.75	10.93	13.13
3/4	2.24	4.48	6.72	8.96	11.20	13.43
11	2.29	4.58	6.87	9.16	11.45	13.75
1/4	2.34	4.69	7.03	9.37	11.72	14.06
1/2	2.39	4.79	7.18	9.58	11.97	14.37
3/4	2.45	4.89	7.34	9.79	12.25	14.69
12	2.5	5.	7.5	10.	12.5	15.

Hosted by Google

REESE, GRAFF & WOODS,

MANUFACTURERS OF

Bar Iron,
Refined Iron,
Sheet Iron,
Plate Iron,
Shingle Strips,
Anvils,
Crow Bars,
Harrow Teeth,
Horse Shoes,
Tool Steel,
Machinery Steel,
Spring Steel,
Plow Steel,
Frog Steel,
Lay Steel,
Sheet Steel,
Saw Steel,
Safe Steel,
Hammer Steel,
Tire Steel,
Blister Steel.



FORT PITT IRON and STEEL WORKS,

PITTSBURG, PA.

Tensil Strength of Bar Iron, 60,000 lbs. to the Square inch.
" Machinery Steel, 100,000 " " "
" Tool " 140,000 " " "

Hosted by Google

Clamps.

Champlin & Rogers.....Chicago, Ill.....See Page 192

Claw and Tamping Bars.

Skinner & Gifford Mfg. Co.....Dunkirk, N. Y.....See Page 140

Clocks.

Ansonia Brass & Copper Co.....New York..... See Page 122
Vose, Dinsmore & Co..... " " ..... " 60

Coach Colors.

Edward Smith & Co.....New York.....See Page 218

Coach Oil.

Eclipse Lubric Oil Co.....New York.....See Page Facing Title
F. S. Pease.....Buffalo, N. Y.....See Page 100

Coach Screws.

G. B. Walbridge.....New York.....See Page 130
Lewis Oliver & Phillips; H. B. Newhall, Agt.. " " ..... " 166
Providence Tool Co.; " " " " " ..... " 166

Coach Varnish.

Edward Smith & Co.....New York.....See Page 218
Valentine & Co..... " " ..... " 198

Coal.

E. L. Hedstrom.....Buffalo, N. Y.....See Page 202
Rhodes & Bradley.....Chicago, Ill..... " 192
Rogers & Co..... " " ..... " 144

WEIGHT OF FLAT IRON.—Continued.

Weight of Running Foot in Pounds.

Width in Ins.	Thickness in Inches. 7/16	1/2	5/8	3/4	7/8	1
1	1.46	1.67	2.08	2.5	2.92	3.33
1/8	1.64	1.87	2.34	2.81	3.28	3.75
1/4	1.82	2.08	2.6	3.12	3.65	4.17
3/8	2.01	2.29	2.86	3.44	4.01	4.58
1/2	2.19	2.5	3.12	3.75	4.37	5.
5/8	2.37	2.71	3.38	4.06	4.74	5.42
3/4	2.55	2.92	3 64	4.37	5.1	5.83
7/8	2.73	3.12	3.9	4.69	5.47	6.25
2	2.92	3.33	4.16	5.	5.83	6.67
1/8	3.1	3.54	4.43	5.31	6.2	7.08
1/4	3.28	3.75	4.69	5.62	6.56	7.5
3/8	3.46	3.96	4.95	5.94	6.93	7.92
1/2	3.65	4.17	5.21	6.25	7.29	8.33
5/8	3.83	4.37	5.47	6.56	7.66	8.75
3/4	4.01	4.58	5.73	6.88	8.02	9.17
7/8	4.19	4.79	5.99	7.19	8.39	9.58
3	4.37	5.	6.25	7.5	8.75	10.
1/8	4.56	5.21	6.51	7.82	9.12	10.42
1/4	4.74	5.42	6.77	8.12	9.48	10.83
3/8	4.92	5.62	7.03	8.44	9.84	11.25
1/2	5.1	5.83	7.29	8.75	10.21	11.67
5/8	5.29	6.04	7.55	9.07	10.59	12.08
3/8	5.47	6.25	7.81	9.37	10 93	12.5
7/8	5.65	6.46	8.07	9.68	11.3	12.92
4	5.83	6.67	8.33	10.	11.65	13.33
1/8	6.02	6.87	8.59	10.3	12.04	13.75
1/4	6.2	7.08	8.85	10.62	12.4	14.15
3/8	6.38	7.29	9.11	10.93	12.75	14.59
1/2	6.56	7.5	9.37	11.25	13.12	15.00
5/8	6.74	7.71	9.64	11.55	13.5	15.42
3/4	6.93	7.92	9.89	11.87	13.85	15.83
7/8	7.11	8.12	10.15	12.2	14.22	16.25
5	7.29	8.33	10.42	12.5	14.59	16.65
1/8	7.48	8.54	10.69	12.8	14.95	17.09
1/4	7.66	8.75	10.93	13.13	15.3	17.5

Hosted by Google

(*Trade Mark.*)

△ EXCELSIOR C

BAND SAW BLADE,

AND

Coil Spring Manufactory,

Nos. 214 and 216 East 119th St., between 2d and 3d Aves., NEW YORK.

BAND SAW BLADES A SPECIALTY.

Steel Cold Rolled to order for the Trade. Also, on hand, in stock, a full assortment of best quality

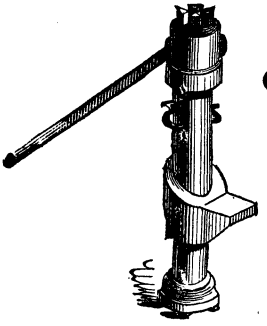
Band Saw Blade and Spring Steel,

MANUFACTURED AND IMPORTED TO SPECIAL ORDER.

C. VAN NESS, Proprietor.

N. B.—Orders by mail promptly attended to. ☞ Send for Circular.

RICH. DUDGEON,



24

Columbia St.,

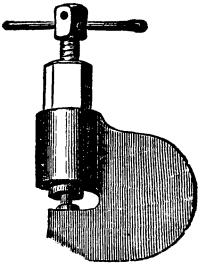
NEW YORK.

MAKER

AND

PATENTEE

OF



Hydraulic Jacks AND Punches,

ROLLER TUBE EXPANDERS,

And Direct-Acting Steam Hammers,

☞ Communication by letter will receive prompt attention. ☜

JACKS for PRESSING ON CAR WHEELS or CRANK PINS

MADE TO ORDER.

Hosted by Google

Coal Facing.

Rogers & Co.....Chicago, Ill.....See Page 144

Coal Hods and Vases.

Sidney Shepard & Co.....Buffalo, N. Y.....See Page 196

Coal Miners' Supplies.

Hart, Ball & Hart.....Buffalo, N. Y.....See Page 136

Coal Washing Machinery.

The Atlas Works.....Pittsburgh, Pa.....See Page 172

Coiled Chain.

De Grauw, Aymar & Co.....New York.....See Page 112
Hermann Boker & Co..... " " .....See Pages 152, 154

Coiled Springs.

C. Van Ness.....New York.....See Page 70

Coking Machinery.

The Atlas Works.....Pittsburgh, Pa.....See Page 172

Cold Rolled Piston Rods.

Jones & Laughlins.....Pittsburgh, Pa.....See Page 32

Colors—Dry.

C. E. Hecht.....Easton, Pa.....See Page 158
Edward Smith & Co.....New York..... " 218
Jno. W. Masury & Son..... " " ..... " 214

WEIGHT OF FLAT IRON.—Continued.

Weight of Running Foot in Pounds.

Width in Ins.	Thickness in Inches.				
	7/16	1/2	5/8	3/4	7/8	1
5 3/8	7.84	8.96	11.2	13.43	15.68	17.92
1/2	8.02	9.17	11.45	13.75	16.03	18.33
5/8	8.2	9.37	11.72	14.07	16.4	18.75
3/4	8.39	9.58	11.99	14.37	16.77	19.15
7/8	8.57	9.79	12.25	14.7	17.13	19.58
6	8.75	10.	12.5	15,	17.5	20.
1/8	8.93	10.2	12.77	15.3	17 85	20.42
1/4	9.11	10.42	13.02	15.62	18.23	20.83
3/8	9.3	10.63	13.29	15.93	18.6	21.25
1/2	9.48	10.83	13.53	16.25	18.97	21.65
5/8	9.67	11.03	13.81	16.57	19.33	22.08
3/4	9.84	11.25	14.05	16.87	19.7	22.5
7/8	10.02	11.45	14.32	17.19	20.03	22.92
7	10.2	11.65	14.59	17.5	20.42	23.33
1/4	10.59	12.09	15.1	18.13	21.15	24.15
1/2	10.93	12.5	15.62	18.73	21.85	25.
3/4	11.31	12.92	16.15	19.39	22.62	25.83
8	11.66	13.33	16.65	20.	23.33	26.65
1/4	12.03	13.75	17 18	20.6	24.05	27.5
1/2	12.4	14.17	17.7	21.25	24.8	28.33
3/4	12.76	14.58	18.23	21.89	25.52	29.17
9	13.12	15.	18.75	22.5	26.23	30.
1/4	13.5	15.42	19.27	23.12	26.98	30.83
1/2	13.85	15.83	19.78	23.73	27.7	31.67
3/4	14.2	16.25	20.32	24 35	28.42	32.5
10	14.59	16.65	20.82	25.	29.15	33.33
1/4	14.93	17.08	21.33	25.62	29 88	34.17
1/2	15.3	17.5	21.89	26.25	30.62	35.
3/4	15.67	17.92	22.4	26.85	31.33	35.83
11	16.03	18.33	22.9	27.5	32.08	36.65
1/4	16.4	18.75	23.43	28.12	32.8	37.5
1/2	16.75	19.15	23.93	28.73	33.52	38.33
3/4	17.13	19.59	24.49	29.35	34.25	39.15
12	17.5	20.	25.	30.	35.	40.

Hosted by Google

JEWETT & SONS
PERFECTLY
PURE
WHITE LEAD
TRADE MARK

THIS IS THE

ONLY QUALITY

OF

WHITE LEAD

That we have made for the past

FIFTEEN YEARS.

JOHN JEWETT & SONS,

182 Front St., New York,

JANUARY 1ST, 1873.

Hosted by Google

Colors, for Freight and Coal Cars.

C E. Hecht.....Easton, Pa.....See Page 158
Jno. W. Masury & Son.....New York..... " 214

Colors—In Oil.

C. E. Hecht.....Easton, Pa.....See Page 158
Jno. W. Masury & Son.....New York..... " 214

Commission Merchants.

C. W. Matthews.....Philadelphia, Pa.....See Page 38
Jno. W. Quincy.....New York..... " 178
Winans & Co..... " " ..... " 106

Compasses.

F. Eckel.....New York.....See Page 76
Kuebler & Seelhorst.....Philadelphia, Pa..... " 216
Wm. J. Young & Sons..... " " ..... " 138

Composition Castings.

Philadelphia Smelting Co.....Philadelphia, Pa.....See Page 134

Condensers.

A. Carr.....New York.....See Page 244

Conductors' Punches.

Allen, Lane & Scott.....Philadelphia, Pa.....See Page 90
Geo. H. Crain & Co.....Chicago, Ill..... " 124
L. W. Pond.....Worcester, Mass..... " 158
Vose, Dinsmore & Co.....New York..... " 60

Contractors.

Geo. H. Crain & Co.....Chicago, Ill.....See Page 124
Joseph Churchyard.....Buffalo, N. Y..... " 160
Phillipsburg Manufacturing Co.....New York..... " 22

Contractors' Machinery.

Speedwell Iron Works.....New York.....See Page 122

LAP WELDED AMERICAN CHARCOAL IRON BOILER TUBES.

Table of Standard Sizes.—Morris, Tasker & Co.

External Diameter.	External Circumference.	Internal Diameter.	Internal Circumference.	Thickness.	Length of Pipe per square foot of inside surface.	Length of Pipe per square foot of outside surface.	Internal Area.	External Area.	Weight, per foot.
Ins.	Ins.	Ins.	Ins.	Ins.	Feet.	Feet.	Ins.	Ins.	lbs.
1	3.142	0.856	2.689	0.072	4.460	3.819	0.575	0.785	0.708
1¼	3.927	1.1[illegible]6	3.474	0.072	3.455	3.056	0.960	1.227	0.9
1½	4.712	1.334	4.191	0.083	2.863	2.547	1.395	1.767	1.250
1¾	5.598	1.560	4.901	0.095	2.448	2.183	1 911	2.405	1.665
2	6.283	1.804	5.667	0.098	2.118	1.999	2.556	3.142	1.981
2¼	7.069	2.054	6.484	0.098	1.850	1.693	3.314	3.976	2.238
2½	7.854	2.283	7.172	0.109	1.673	1.528	4.094	4.9[illegible]9	2.755
2¾	8.639	2.533	7.957	0.109	1.508	1.390	5.039	5.940	3.045
3	9.425	2.783	8.743	0.109	1.373	1.273	6.083	7.069	3.333
3¼	10.210	3.012	9.462	0.119	1.268	1.175	7.125	8.296	3.958
3½	10.995	3.262	10.248	0.119	1.171	1.091	8.357	9.621	4.272
3¾	11.781	3.512	11.033	0.119	1.088	1.018	9.687	11.045	4.590
4	12.566	3.741	11.753	0.130	1.023	0.955	10.992	12.566	5.320
4½	14.137	4.241	13.323	0.130	0.901	0.849	14.126	15.904	6.010
5	15.708	4.72	14.818	0.140	0.809	0.764	17.497	19.635	7.226
6	18.849	5.699	17.904	0.151	0.670	0.637	25.509	28.274	9.346
7	21.991	6.657	2 .914	0.172	0.574	0.545	34.8[illegible]5	38.484	12.435
8	25.132	7.636	23.989	0.182	0.500	0.478	45.795	50.265	15.109
9	28.274	8.615	27.055	0.193	0.444	0.424	58.291	63.617	18.002
10	31.416	9.573	30.074	0.214	0.399	0.382	71.975	78.540	22.19

Hosted by Google

JEWETT'S
PURE
LINSEED
OIL

RAW, BOILED
AND REFINED.

Factory, Port Richmond, Staten Island.

JOHN JEWETT & SONS,

Office, 182 Front St.,

NEW YORK.

Hosted by Google

Contractors' Supplies.

Greene & Randolph.....New York.....See Page 54
Pratt & Co.....Buffalo, N. Y..... " 132

Contractors' Tools.

Jno. Bayliss.....New York.....See Page 76

Copper.

Ansonia Brass & Copper Co.....New York.....See Page 122
Bruce & Cook..... " " ..... " 112
Chas. W. Matthews.....Philadelphia, Pa..... " 38
Geo. Worthington & Co.....Cleveland, Ohio..... " 109
Holmes & Lissberger.....New York..... " 84
Philadelphia Smelting Co.....Philadelphia, Pa..... " 134
Sidney Shepard & Co.....Buffalo, N. Y..... " 196

Copper—Bottoms.

Holmes & Lissberger.....New York.....See Page 84

Copper—Ingot.

Lucius Hart & Co.....New York.....See Page 56
Jno. W. Quincy..... " " ..... " 178

Copper—Locomotive Sheets.

Ansonia Brass & Copper Co.....New York.....See Page 122
Holmes & Lissberger..... " " ..... " 84

Copper Nails.

Ansonia Brass & Copper Co.....New York.....See Page 122

Copper Rivets and Burs.

Ansonia Brass & Copper Co.....New York.....See Page 122
Holmes & Lissberger..... " " ..... " 84

Copper Tubing.

Ansonia Brass & Copper Co.....New York.....See Page 122
Holmes & Lissberger..... " " ..... " 84

PAINTER'S PUTTY.

Spanish whiting, pulverized..... 81.6 } Made into a stiff paste. If not intended for
Boiled Oil..... 20.4 } immediate use, raw oil should be used.

One pound of putty for stopping every 20 yards.

GLAZIER'S PUTTY.

Whiting, 70 pounds; boiled oil, 30 pounds; water, 2 gallons. Mix. If too thin, add more whiting; if too thick, add more oil.

TO SOFTEN PUTTY.

To remove old putty from broken windows, dip a small brush in nitro-muriatic acid or caustic soda (concentrated lye), and with it annoint or paint over the dry putty that adheres to the broken glass and frames of your windows; after an hours interval, the putty will have become so soft as to be easily removable.

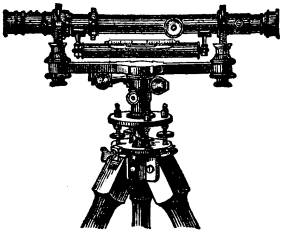
WEIGHT OF ONE FOOT OF COPPER RODS.

Diameter in inches.	Pounds.	Diameter in inches.	Pounds.	Diameter in inches.	Pounds.
1/4	.189	1 1/8	3.831	2 3/8	17.075
5-16	.295	3-16	4.269	1/2	18.916
3/8	.425	1/4	4.736	5/8	20.856
7-16	.579	5-16	5.214	3/4	22.891
1/2	.756	3/8	5.730	7/8	25.019
9-16	.958	7-16	6.254	3.	27.243
5/8	1.182	1/2	6.811	1/8	29.560
11-16	1.430	9-16	7.389	1/4	31.972
3/4	1.702	5/8	7.993	3/8	34.481
13-16	1.998	3/4	9.270	1/2	37.080
7/8	2.317	7/8	10.642	5/8	39.777
15-16	2.660	2.	12.108	3/4	42.568
1.	3.027	1/8	13.667	7/8	45.455
1-16	3.417	1/4	15.325	4.	48.433

Hosted by Google

Frederick Eckel,

MANUFACTURER OF



ENGINEERS'

AND

SURVEYORS'

INSTRUMENTS,

Transits, Levels,

CHAINS, TAPES, RODS, &c.

WARRANTED THE BEST QUALITY.

INSTRUMENTS CAREFULLY REPAIRED and ADJUSTED

10 BURLING SLIP, COR. WATER ST.,

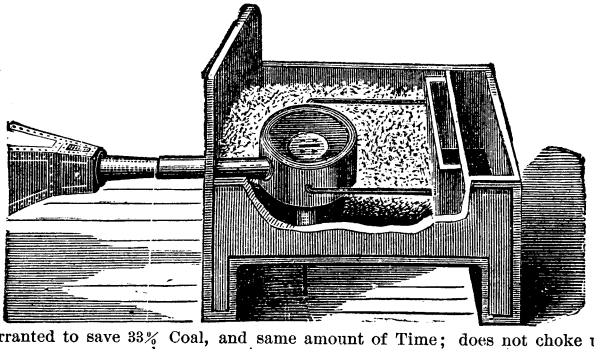
NEW YORK.

JOHN BAYLISS,

157 EAST 54th STREET, - NEW YORK,

PATENT VERTICAL HOT BLAST and WATER

TUYERES AND FORGES.



Warranted to save 33% Coal, and same amount of Time; does not choke up or burn up. ALSO, MANUFACTURER OF

CONTRACTORS' TOOLS AND RAILROAD SUPPLIES.

☞ SEND FOR CATALOGUE

Hosted by Google

Copper Wire.

Ansonia Brass & Copper Co.....New York.....See Page 122

Copper Wire—Insulated.

Charles T. Chester.....New York.....See Page 212
Geo. W. Mowbray.....North Adams, Mass..... " 182

Copying Presses.

T. Shriver & Co.....New York.....See Page 194

Cordage.

De Grauw, Aymar & Co.....New York.....See Page 112
Sidney Shepard & Co.....Buffalo, N. Y..... " 196

Corrugated Iron.

John Merry & Co.....New York.....See Page 48
Marshall Lefferts, Jr..... " " ..... " 44
Noyes & Wines..... " " ..... " 264
Tyng & Co.....New York..... " 260

Cotter Drills.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Cotton Waste.

J. J. Walworth.....Chicago, Ill.....See Page 124
L. G. Tillotson & Co.....New York..... " 94
Radley & McAlister Manufacturing Co..... " " ..... " 250
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138
Vose, Dinsmore & Co.....New York..... " 60

Couplings.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116
Darrow, Turner & Co.....New York..... " 62
Radley & McAlister Manufacturing Co..... " " ..... " 250
Vose, Dinsmore & Co..... " " ..... " 60

Covered Wires—Silk and Cotton.

Bishop Gutta Percha Works.....New York.....See Page 34
C. Thompson.....Philadelphia, Pa..... " 222
Charles T. Chester.....New York..... " 212
Geo. H. Bliss & Co.....Chicago, Ill..... " 164
Leclanche Battery Co.....New York..... " 96

SURFACE HARDENING OF CAST-IRON.

The wearing of cast-iron surfaces exposed to sliding friction can be almost wholly prevented by tempering the surface with a mixture of 21 1-10 pints of water, 30¾ pounds of sulphuric acid, and 1,003 grains of nitric acid. The article should be heated to a cherry-red, and protected from the oxidizing effect of currents of air by a sheet-iron box. The process is especially adapted to the hardening of bearings of axles, which, while much cheaper than those of the usual alloy, will, when regularly ubricated, last as long, even when there is great rapidity of motion.

RIVETED IRON PIPES.

Weight per Running Foot.

These weights include laps for riveting and calking, but not the rivets, the weight of which depends upon the sizes and number used.

Bore. Inch.	Thickness of Metal, Inch. ⅛	⅜	¼
5	7.15	10.7	14.23
½	7.8	11.71	15.61
6	8.45	12.6	16.85
½	9.05	13.61	18.15
7	9.75	14.65	19.55
½	10.45	15.7	20.85
8	11.15	16.65	22.25
½	11.85	17.6	23.55
9	12.5	18.75	25.
½	13.15	19.75	26.25
10	13.96	20.8	27.7
½	14.45	21.75	29.1

Bore. Inch.	Thickness of Metal, Inch. ⅜	¼	5/16
11	22.75	30.45	38.15
12	24.8	33.	41.25
13	26.75	35.75	44.55
14	28.65	38.45	47.1
15	30.83	41.	51.45
16	32.94	43.75	54.75
17	34.85	46.45	58.1
18	36.3	49.1	61.4
19	38.	51.75	64.7
20	41.2	55.6	68.

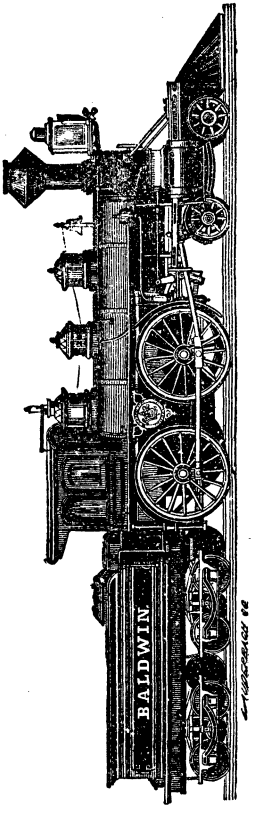
Hosted by Google

Baldwin Locomotive Works

M. BAIRD & CO.,

PHILADELPHIA,

MANUFACTURERS OF



LOCOMOTIVE ENGINES.

ESPECIALLY ADAPTED TO EVERY VARIETY OF RAILROAD SERVICE, INCLUDING

Mining Engines and Locomotives for Narrow Gauge Railways.

ALL WORK ACCURATELY FITTED TO GAUGES,

AND THOROUGHLY INTERCHANGEABLE,

Plan, Materials, Workmanship, Finish and Efficiency

FULLY GUARANTEED

M. BAIRD.
GEO. BURNHAM.

CHAS. T. PARRY.
EDW'D H. WILLIAMS.

WM. P. HENSZEY.
EDW'D LONGSTRETH.

Hosted by Google

Cranes.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64
Wm. B. Bement & S n..... " " ..... " 168

Crestings.

J. D. West & Co.....New York.....See Page 56

Crossing and Frogs.

Anderson & Woods.....Pittsburgh, Pa.....See Page 150
The Atlas Works..... " " ..... " 172

Crow-Bars—Iron and Steel.

Anderson & Woods.....Pittsburgh, Pa.....See Page 150
G. B. Walbridge.....New York..... ..... " 130
Hermann Boker & Co..... ..... " " .....See Pages 152, 154
Providence Tool Co; H. B. Newhall, Agent..... " " .....See Page 166
Reese, Graff & Woods..... .....Pittsburgh, Pa..... " 68

Crucibles.

Du Plaine & Reeves..... .....Philadelphia, Pa.....See Page 102
Van Tuyl Manufacturing Co.....New York..... " 242

Crude Gutta Percha for Cement.

Bishop Gutta Percha Works.....New York.....Sec Page 34

Cupola Linings.

Hall & Sons.....Buffalo, N. Y.....See Page 254
Maurer & Weber..... .....New York..... ..... " 228
Philip Neukumet.....Philadelphia, Pa..... " 104
Star Fire Brick Co.....Pittsburgh, Pa..... " 232

DRIVING WHEELS.

Number of Revolutions per Mile.

Diameter of Wheel.....	2 ft.	2½ ft.	3 ft.	3½ ft.	4 ft.	4½ ft.	5 ft.
Revolutions per Mile...	840	672	560	480	420	373	336
Diameter of Wheel.....	5½ ft.	6 ft.	6½ ft.	7 ft.	8 ft.	9 ft.	10 ft.
Revolutions per Mile...	305½	280	258½	240	210	187	168

VELOCITY AND FORCE OF THE WIND.

Description.	Miles per hour.	Feet per minute.	Feet per second.	Force in lbs. per sq. foot.
Hardly perceptible.....	1	88	1.47	.005
Just perceptible.....	2	176	2.93	.020
	3	264	4.4	.044
Gentle breeze.....	4	352	5.87	.079
	5	440	7.33	.123
Pleasant breeze.....	10	880	14.67	.492
	15	1320	22	1.107
Brisk gale.....	20	1760	29.3	1 968
	25	2200	36.6	3.075
High wind.....	30	2640	44	4.428
	35	3080	51.3	6.027
Very high wind.....	40	3520	58.6	7.872
	45	3960	66.0	9.963
Storm	50	4400	73.3	12.300
Great Storm	60	5280	88.0	17.712
	70	6160	102.7	24.108
Hurricane.....	80	7040	117.3	31.488
	100	8800	146.6	49.200

PAINT FOR TARPAULINS.

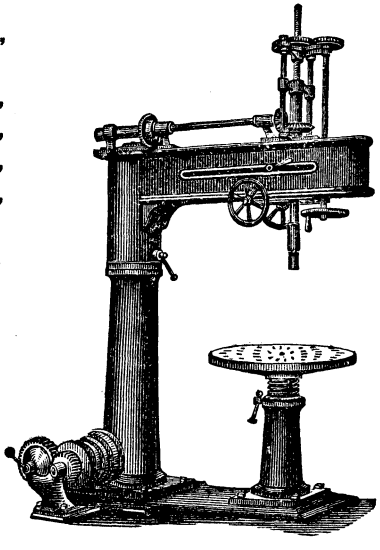
First. Olive—Liquid, Olive color..... ..... 10.
Beeswax..... 6.
Spirits turpentine..... 6.

Dissolve the beeswax in spirits of turpentine, with a gentle heat, and mix the paint warm.

Second. Add 12 ounces of beeswax to one gallon of linseed oil, boil it two hours; prime the cloth with this mixture, and use it in place of boiled oil, for mixing the paint.

Hosted by Google

Lathes,
Planers,
Slotters,
Shapers,
Boring Mills,
Bolt Cutters,
Bolt Headers,
Rivet Machines,
Milling Machines,
Screw Machines,
Nut Tappers,
Gear Cutters
Gang Drills,
Axle Lathes,



Car Wheel Boring Mills,
Wheel Presses,
Scrap Shears,
Punch and Shears,
Vertical Drills,
Cutting Off Machines,
Radial Drills,
Steam Pumps,
Portable Hoisters
Portable Drills,
Agricultural Engines,
Shafting, Hangers,
Pulleys, Belting,
&c., &c.

ISAAC H. SHEARMAN,

132 North Third St., and 301 Cherry St.,

PHILADELPHIA,

MACHINERY COMMISSION HOUSE,

Steam Engines, Boilers,

AND

MACHINISTS' TOOLS,

SPECIALTIES.

Warren's Shaper. Schlenker's Bolt Cutter.

Durrell's Nut Tapper *(Taps 7 Nuts at Once.)*

Barr's Radial Drill.

Heavy Lathes, Adapted to Railroad Work.

Hosted by Google

Cupolas.

Wm. B. Bement & Son.....Philadelphia, Pa.....See Page 168
Wm. Sellers & Co..... " " ..... " 64

Cutlery.

England & Bindley.....Pittsburgh, Pa .....See Page 162
G. B. Walbridge.....New York ..... " 130
Hermann Boker & Co..... " " .....See Pages 152, 154
Pratt & Co.....Buffalo, N. Y.....See Page 132

Cutting Nippers.

Biddle Manufacturing Co.....New York.....See Page 12

Cylinders.

The Atlas Works..... .....Pittsburgh, Pa.....See Page 172

Cylinder Boring and Facing Machines.

Wm. Sellers & Co..... .....Philadelphia, Pa.....See Page 64

Dating Machines.

Allen, Lane & Scott.....Philadelphia, Pa. .....See Page 90
Mathiesen & Schrader.....New York..... " 82

Depot Scales.

Buffalo Scale Company.....Buffalo, N. Y.....See Page 40
Jones Scale Works.....Binghamton, N. Y..... " 92

Derricks.

Skinner & Gifford Manufacturing Co.....Dunkirk, N. Y.....See Page 140

STEAM.

THE ELASTIC FORCE OF STEAM AND CORRESPONDING TEMPERATURE OF THE WATER WITH WHICH IT IS IN CONTACT.

(*From Haslett.*)

Pressure on a Square Inch. lbs.	Elastic Force in Inches of Mercury.	Temperature of Water in Degrees of Fahrenheit.	Volume of Steam compared with the Volume of Water.	Pressure on a Square Inch. lbs.	Elastic Force in Inches of Mercury.	Temperature of Water in Degrees of Fahrenheit.	Volume of Steam compared with the Volume of Water.
14.7	30.00	212.0	1700	68	138.72	304.4	419
15	30.60	212.8	1669	70	142.80	306.4	408
16	32.64	216.3	1573	72	146.88	308.4	398
18	36.72	222.7	1411	74	150.96	310.3	388
20	40.80	228.5	1281	76	155.06	312.2	379
22	44.88	233.8	1174	78	159.14	314.0	370
24	48.96	23 .7	1084	80	163.22	315.8	362
26	53.04	243.3	1007	82	167.30	317.6	354
28	57.12	247.6	941	84	171.38	319.3	346
30	61.21	251.6	883	86	175.46	321.0	339
32	65.28	255.5	833	88	179.54	322.6	332
34	69.36	259.1	788	90	183.62	324.3	325
36	73.44	262.6	748	92	187.70	325.9	319
38	77.52	265.9	712	94	191.78	327.5	313
40	81.60	269.1	679	96	195.86	329.0	307
42	85.68	272.1	649	98	199.92	330.5	301
44	89.76	275.0	622	100	204.01	332.0	295
46	93.84	277.8	598	110	224.40	339.2	271
48	97.92	280.5	575	120	244.82	345.8	251
50	102.00	283.2	554	130	265.23	352.1	233
52	106.08	285.7	534	140	285.61	357.9	218
54	110.16	288.1	516	150	306.03	363.4	205
56	114.24	290.5	500	160	326.42	368.7	193
58	118.32	292.9	484	170	346.80	373.6	183
60	122.40	295.6	470	180	367.25	378.4	174
62	126.48	298.1	456	190	387.61	382.9	166
64	130.56	300.3	443	200	408.04	387.3	158
66	134.64	302.4	431				

Hosted by Google

MATHIESEN & SCHRADER,

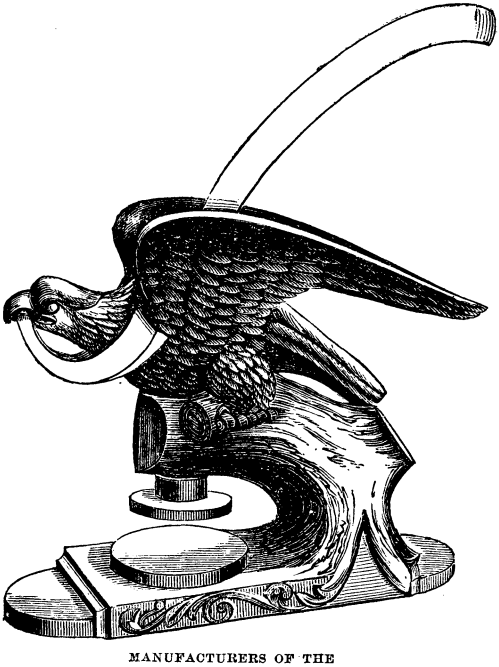
Engravers, Die Sinkers and Machinists.

STEEL DIES,

Soap Stamps and Stamps of Every Description

EXECUTED IN THE BEST MANNER.

MANUFACTURERS OF Telegraph Instruments.



Brass Finishing AND Model Making.

MANUFACTURERS OF THE

EAGLE SEAL PRESS.

This Seal Press is the Steadiest Working Press in the United States.

Gear Wheels and Pinions Cut, and all kinds of Type Wheels Engraved.

142 FULTON STREET, NEW YORK.

CHARLES MATHIESEN, Engraver. JOHN SCHRADER, Machinist.

Hosted by Google

Desks and Office Furniture.

A. L. Hale & Bro .....Chicago, Ill.....See Page 206
Joseph Churchyard.....Buffalo, N. Y..... " 160

Dies.

Champlin & Rogers.....Chicago, Ill..... See Page 192
J. J. Walworth..... " " ..... " 124
Mathiesen & Schrader.....New York..... " 82

Door Knobs.

Romer & Co.....Newark, N. J.....See Page 204

Door Machinery.

C. B. Rogers & Co.....New York.....See Page 210
J. A. Fay & Co.....Cincinnati, Ohio..... " 206
Richards, London & Kelley.....Philadelphia, Pa..... " 66

Drawing Room Car Hassocks, &c.

George Drake Smith.....Philadelphia, Pa.....See Page 246
New York Ottoman & Hassock Co.....New York..... " 236

Drill Grinding Machines.

Wm. Sellers & Co..... ...Philadelphia, Pa..... See Page 64

STRENGTH AND EQUIVALENTS OF FLAT ROPES.

Manchester (England) List.

Breaking Strain. Tons.	Working Load. Cwt.	Hemp. Circumference. Inches.	Iron Wire. Circumfereuce. Inches.	Steel Wire. Circumfereuce. Inches.
16	32	3 by 1	1⅞ by ½	
20	40	4 " 1⅛	2 " ⅝	
22	48	5 " 1¼	2¾ " ½	
24	56	5¼ " 1½	2⅞ " ⅝	1⅞ by ⅝
26	64	5½ " 1⅝	3 " ⅝	2 " ⅝
27	72	5¾ " 1½	3¼ " ⅝	
28	80	6 " 1½	3½ " ¾	2¾ " ½
32	88	6½ " 1⅝	3¾ " ¾	
36	96	7 " 1⅞	4 " ¾	2⅞ " ⅝
40	108	7½ " 2	4¼ " ⅞	3 " ⅝
46	120	8½ " 2¼	4½ " ⅞	3¼ " ⅞
58	145	10 " 2½	5 " ⅞	3¼ " ¾
70	175	11½ " 2¾	5½ " 1	4¼ " ⅞
85	210	13 " 3	6 " 1	4⅝ " ⅞

WEIGHT OF FLAT ROPES.

Manchester (England) List.

Hemp. Size in Inches.	Weight per Fathom. Lbs.	Iron Wire. Size in Inches.	Weight per Fathom. Lbs.	Steel Wire. Size in Inches.	Weight per Fathom. Lbs.
3 by 1	16	1⅞ by ½	8	1⅞ by ½	8
4 " 1⅛	20	2 " ⅝	10	2 " ⅞	10
5 " 1¼	22	2¾ " ½	12	2¾ " ½	12
5¼ " 1¼	24	2⅞ " ½	14	2⅞ " ½	12
5½ " 1⅜	26	3 " ⅝	16	3 " ⅝	16
5¾ " 1½	27	3¼ " ⅝	18	3¼ " ⅝	18
6 " 1½	28	3½ " ¾	20	3½ " ¾	24
6½ " 1⅝	32	3¾ " ¾	22	4¼ " ¾	28
7 " 1⅞	36	4 " ¾	24	4⅝ " ⅞	34
7½ " 2⅛	40	4¼ " ⅞	28		
8½ " 2¼	45	4½ " ⅞	30		
10 " 2½	63	5 " ⅞	39		
11½ " 2¾	78	5½ " 1	48		
13 " 3	98	6 " 1	59		

Hosted by Google

E. S. LUNT,

IMPORTER AND JOBBER OF

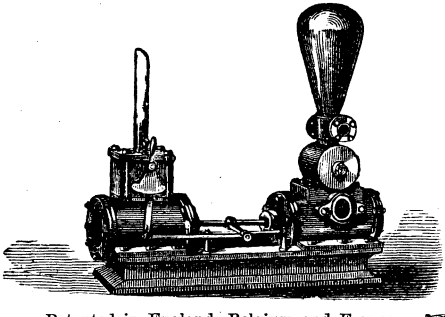
Railway Car and Carriage Linings,

Plushes, Cloths, Carpets, Satins,

CURTAIN SILKS, COTELINES, &c.

99 CHAMBERS ST., CORNER OF CHURCH, NEW YORK.

NIAGARA STEAM PUMP WORKS



This Pump has taken the first premium at every Fair in the United States where there has been a practical test.

CHAS. B. HARDICK,

23 Adams Street,

BROOKLYN, N. Y.

SOLE MANUFACTURER OF

Hardick's Patent Double Acting Steam Pumps and Fire Engines.

Patented in England, Belgium and France. ☞ Send for Circular.

HOLMES & LISSBERGER,

IMPORTERS AND DEALERS IN

COPPER.

MANUFACTURERS OF

Locomotive Fire Box Sheets and Flues, Braziers' and Sheet Copper, Kettle Bottoms, Bolts, Rivets, Strips, Circles and Tubes, Pig and Ingot Copper, Spelter, Solder, Tin and Lead, Pig Iron, Old Rails, &c., &c., &c.

255 & 257 PEARL STREET, - NEW YORK.

AGENTS FOR THE NEW HAVEN COPPER CO.

Hosted by Google

Drills.

Barwick Wrench Co.....Boston, Mass.....See Page 60
L. W. Pond.....Worcester, Mass ..... " 158
Rand & Waring Drill & Compressor Co.....New York.....See Front Page.
See also Drilling Machines, Tools, &c.

WIND MILLS.

Deduction from Velocities varying from 4 to 9 Feet per Second. (Haswell.)

1. The velocity of wind-mill sails, so as to produce a maximum effect, is nearly as the velocity of the wind, their shape and position being the same.
2. The load at the maximum is nearly, but somewhat less than, as the square of the velocity of the wind, the shape and position of the sails being the same.
3. The effects of the same sails, at a maximum, are nearly, but somewhat less than, as the cubes of the velocity of the wind.
4. The load of the same sails, at the maximum is nearly as the squares, and their effect as the cubes of their number of turns in a given time.
5. When sails are loaded so as to produce a maximum effect at a given velocity, and the velocity of the wind increases, the load continuing the same—*First*., the increase of effect, when the increase of the velocity of the wind is small, will be nearly as the squares of those velocities; *Secondly*, when the velocity of the wind is double, the effects will be nearly as 10 to 27½; *Thirdly*, when the velocities compared are more than double of that when the given load produces a maximum, the effects increase in nearly the same ratio of the velocity of the wind.
6. In sails where the figure and position are similar, and the velocity of the wind the same, the number of revolutions in a given time will be reciprocally as the radius or length of the sail.
7. The load, at a maximum, which sails of a similar figure and position will overcome at a given distance from the centre of motion is as the cube of the radius.
8. The effects of sails of similar figure and position are as the square of the radius.
9. The velocity of the extremities of Dutch sails, as well as of the enlarged sails, in all their usual positions when unloaded, or even loaded to a maximum, is considerably greater than that of the wind.

Rule for the Angles of the Sails. (Molesworth.)

A = Angle of the sail with the plane of motion at any part of the sail.
R = Total radius of sail in feet.
D = Distance of any part of the sail from the axis.

$$A = 23° - \frac{18\ D^2}{R^2}$$

If the radius of the wind mill sails be divided into six equal parts, the angles at each of those parts will be as follows, reckoning from the axis:

Distance from axis	1–6	2–6	3–6	4–6	5–6	tip
Angle of sail with axis	67½°	69°	71½°	75°	79½°	85°
Angle of sail with plane of motion	22½	21	18½	15	10½	5

Axis of shaft of wind mill with horizon..... = 8° on level ground.
" " " " ..... = 15° on high exposed positions.
Breadth of whip at axis..... = 1-30th length of whip.
Depth " " ..... = 1-40th "
Breadth of whip at tip..... = 1-60th "
Depth " " ..... = 1-80th "
Width of sail . " ..... = 1-3d "
Divided by the whip in the proportion of 5 to 3, the narrow portion being nearest to the wind.
Width of sail at axis..... = 1-5th length of whip.
Distance of sail from axis..... = 1-7th " "
Cross-bars from 16 to 18 inches apart.

Horse-Power and Sail-Area of Wind Mills.

HP = Horse-power.
V = Velocity of wind in feet per second.
A = Total area of sails in square feet.
N = Number of sails.

$$A = \frac{HP\ 1080000}{V^3}.$$

$$HP = \frac{A\ V^3}{1080000}.$$

Area of each sail = A ÷ N. Velocity of tips of sails = 2.6 V, nearly.

Hosted by Google

JOSEPH GILLOTT'S STEEL PENS.

Sold by all Dealers.

Each Pen is Stamped with the Maker's Name and its Particular Number.

THE WELL KNOWN NUMBERS:

303, 404, 170, 351,

Having been assumed by other makers, we **CAUTION** the Public

AGAINST IMITATIONS.

An injunction against infringements of our right to the above numbers and others as trade marks, was granted in 1867, and AFFIRMED by the Court of Appeals January, 1872.

Manufacturers' Warehouse,

91 JOHN STREET, N. Y.

JOSEPH GILLOTT & SONS.

HENRY HOE, Sole Agent.

Hosted by Google

Drilling Machines.

Buffalo Machinery Agency.....Buffalo, N. Y.....See Page 160
England & Bindley.....Pittsburgh, Pa..... " 162
Isaac H. Shearman.....Philadelphia, Pa..... " 80
Rand & Waring Drill & Compressor Co.....New York.....See Front Page
The Pratt & Whitney Co.....Hartford, Conn.....See Page 142
Thorne, De Haven & Co.....Philadelphia, Pa..... " 38
Wm. B. Bement & Son..... " " ..... " 168

Drill Presses.

Phelps & Sanger.....Cleveland, Ohio.....See Page 120
Wm. Sellers & Co.....Philadelphia, Pa..... " 64

Driving Wheel Lathes.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Drop Presses.

Winans & Co.....New York.....See Page 106

Dryers.

Brooklyn White Lead Co.....New York.....See Page 268
Jno. W. Masury & Son..... " " ..... " 214
Wetherill & Bro.....Philadelphia, Pa..... " 52

Edge Tools.

G. B. Walbridge.....New York.....See Page 130
Hermann Boker & Co..... " " ....See Pages 152, 154

Electrical Engineers.

Charles T. Chester ....New York.....See Page 212
M. A. Buell .....Cleveland, Ohio..... " 46
Towle & Unger Manufacturing Co.....New York..... " 186

Electric Alarms.

Charles T. Chester.....New York.....See Page 212
M. A. Buell.....Cleveland, Ohio..... " 46
Towle & Unger Mfg. Co.....New York..... " 186

STRENGTH AND EQUIVALENTS OF ROUND ROPES.

Manchester (England) List.

Breaking Strain. Tons.	Working Load. Cwt.	Hemp. Circumference. Inches.	Iron Wire. Circumference. Inches.	Steel Wire. Circumference Inches.
3/4	1 1/2	1 1/2	3/4	
1	3	1 3/4	7/8	
1 1/2	4	2	1 1/8	3/4
2	6	2 1/4	1 1/4	7/8
2 1/2	8	2 1/2	1 3/8	1 1/8
3	10	2 3/4	1 1/2	1 1/4
4	15	3	1 3/4	1 3/8
5	18	3 1/2	1 7/8	1 1/2
6	20	3 3/4	2	
6 1/2	22	4	2 1/8	
7	24	4 1/2	2 1/4	1 3/4
8	27	4 3/4	2 3/8	
9	28	5	2 1/2	1 7/8
10	34	5 1/2	2 1/2	2
11	36	6	2 3/4	2 1/8
13	42	6 1/2	2 7/8	2 1/4
14	45	7	3	2 3/8
15	50	7 1/2	3 1/8	2 1/2
17	57	8	3 3/8	2 3/8
19	66	8 1/2	3 1/2	2 3/4
21	70	9	3 5/8	2 7/8
23	78	9 1/2	3 3/4	3
25	84	10	4	3 1/8
29	96	11	4 1/4	3 3/8
34	108	11 1/2	4 5/8	3 1/2
36	120	12	5	3 5/8
41	135	12 1/2	5 1/2	4
48	160	13	6	4 1/4

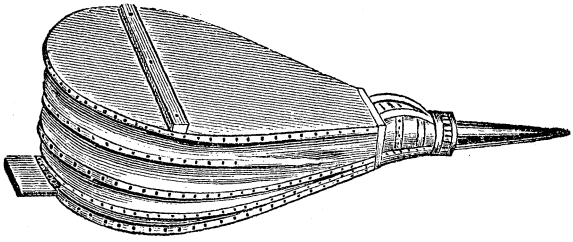
Hosted by Google

GEO. E. NEWCOMB. JAS. W. NEWCOMB. JOHN H. NEWCOMB

NEWCOMB BRO'S. SONS,

MANUFACTURERS OF

SMITHS', MOULDERS' and HAND



ALSO THE SOLE MANUFACTURERS

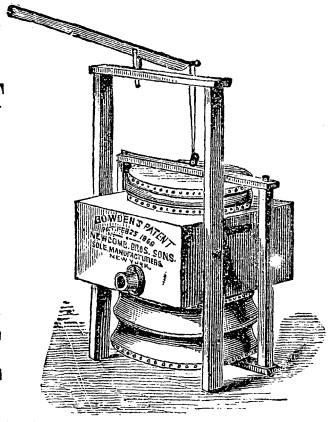
OF

BOWDEN'S PATENT

TRIPLE-ACTION

FORGE

BELLOWS.



These Bellows are superior to all others now in use.

They can be used either in single or double action, for light or heavy work as required. They maintain a steady and continuous blast, the air being forced into the chest both at the up and down stroke. The strength of blast obtained is double that of the ordinary bellows of the same dimensions. They work easily. While the blast is double, the power required to work them is no more than that of a common bellows. Being fully rigged and geared, ready for work, and easily moved from place to place, they are very convenient for railroad, mining, and other purposes where portable bellows are required. They economize space, occupying only half the room of an ordinary bellows. These bellows come to hand at once. A good blast is obtained at the first stroke, and no time or labor is lost, as in the old single-action bellows, in getting up a good blast. They can be made of any size and shape, to suit all requirements. They are the cheapest bellows in the world. With all the advantages of double-action, they cost no more, power for power, than the common single action of same quality.

☞ *For further particulars send for descriptive circular and price list.*

586 WATER ST., near Montgomery, NEW YORK.

STATE RIGHTS FOR SALE.

Canal Street, East Broadway and South Street Cars cross Montgomery Street.

Hosted by Google

Electric Apparatus for Mining.

Geo. W. Mowbray.....North Adams, Mass.....See Page 182
Laflin & Rand Powder Co.....New York.....See Last Page

Electric Bells.

Charles T. Chester.....New York.....See Page 212
Geo. H. Bliss & Co.....Chicago, Ill..... " 164
Leclanche Battery Co.....New York..... " 96

Electric Instruments.

Charles T. Chester.....New York.....See Page 212
F. L. Pope & Co..... " " ..... " 184
Geo. H. Bliss & Co.....Chicago, Ill..... " 164
Leclanche Battery Co.....New York..... " 96
L. G. Tillotson & Co..... " " ..... " 94
M. A. Buell.....Cleveland, Ohio..... " 46
Merchants' Manufacturing & Construction Co..New York..... " 18
Towle & Unger Manufacturing Co..... " " ..... " 186

Electric Machinery.

Charles T. Chester.....New York.....See Page 212
F. L. Pope & Co..... " " ..... " 184
Geo. H. Bliss & Co.....Chicago, Ill..... " 164
Leclanche Battery Co.....New York..... " 96
L. G. Tillotson & Co..... " " ..... " 94
M. A. Buell.....Cleveland, Ohio..... " 46
Merchants' Manufacturing & Construction Co..New York..... " 18
Towle & Unger Manufacturing Co..... " " ..... " 186

WEIGHT OF ROUND ROPES.

Manchester (England) List.

Hemp.		Iron Wire.		Steel Wire,	
Circumference. Inches.	Weight per fathom. Lbs.	Circumference. Inches.	Weight per fathom. Lbs.	Circumference. Inches.	Weight per fathom. Lbs.
1½	¾	¾	½	¾	½
1¾	1	⅞	¾	⅞	¾
2	1½	1	⅞	1⅛	1
2¼	2	1⅛	1	1¼	1¼
2½	2½	1¼	1¼	1⅜	1½
2¾	3	1⅜	1½	1½	1¾
3	3½	1½	1¾	1⅝	2½
3½	4	1¾	2½	1¾	3
3¾	4½	1⅞	3	2	3¼
4	5	2	3¼	2⅛	3¾
4½	6	2⅛	3¾	2¼	4
4¾	6½	2¼	4	2⅜	4¼
5	7	2⅜	4½	2½	4¾
5½	8	2½	4¾	2⅝	5½
6	9	2⅝	5½	2¾	6
6½	10	2¾	6	2⅞	7
7	12	2⅞	7	3	7½
7½	14	3	7½	3⅛	8½
8	16	3⅛	8¼	3⅜	9¼
8½	20	3⅜	9½	3½	11
9	22	3½	11	3⅝	11¾
9½	25	3¾	13	4	14
10	28	4	14	4¼	16
11	29	4¼	16		
11½	30	4⅝	18		
12	32	5	20		
12½	33	5½	23		
13	37	6	27		

Above weights are calculated with Hemp-hearts strands; sol'd made ropes are 1-6th heavier.

Hosted by Google

CONSECUTIVELY-NUMBERED

Local and Coupon Tickets,

Conductors' Ticket Books & Checks,

CERTIFICATES OF STOCK,

BLANK BOOKS,
ORDERS,
BONDS,
CHECKS,
DRAFTS,
NOTES,

An IMPROVED DATER for LOCAL TICKETS.

ALLEN, LANE & SCOTT,

RAILROAD PRINTING HOUSE

233 SOUTH FIFTH ST., PHILADELPHIA.

RULING AND BOOKBINDING.

MAP BILLS,
MORTGAGES,
TIME TABLES,
MANIFESTS,
WAY-BILLS,
VOUCHERS,
VISITING CARDS,
ENVELOPES, &c.

DISPLAY CARDS & BILLS
PLAIN OR IN COLORS.

DATING MACHINES AND HAND STAMPS.

LOCAL AND COUPON TICKET CASES.

Agents for Engels' Conductor's Punch.

Hosted by Google

Electric Signals.

Charles T. Chester.....New York.....See Page 212
The Electric Railroad Signal Co..... " ..... " 184
Towle & Unger Manufacturing Co..... " ..... " 186

Electric Supplies.

Charles T. Chester.....New York.....See Page 212
F. L. Pope & Co.....New York..... " 184
Geo. H. Bliss & Co.....Chicago, Ill..... " 164
Leclanche Battery Co.....New York..... " 96
L. G. Tillotson & Co ..... " " ..... " 94
M. A. Buell.....Cleveland, Ohio..... " 46
Merchants' Manufacturing & Construction Co..New York..... " 18
Towle & Unger Manufacturing Co..... " " ..... " 186

Elevators.

Speedwell Iron Works.....New York.....See Page 122

Emery.

Champlin & Rogers.....Chicago, Ill.....See Page 192
D. Brewer & Co.....Philadelphia, Pa..... " 246
T. B. Bickerton & Co..... " ..... " 138

Emery Belts.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Emery Grinders.

Champlin & Rogers..... .....Chicago, Ill.....See Page 192

GALVANIZED SHEET IRON.

Weight per Square Foot in ounces; Size by Numbers of Wire Gauge.

Size.	Weight	Size.	Weight	Size.	Weight	Size.	Weight
30	10	26	15	22	21	18	37
29	11	25	16	21	24	17	43
28	12	24	17	20	28	16	48
27	14	23	19	19	33	14	60

SHIP SPIKES.

Number in 100 lbs.

Size in Inches. Side.	Length.	No. in 100 lbs.	Size in Inches. Side.	Length.	No. in 100 lbs.	Size in Inches. Side.	Length.	No. in 100 lbs.
1/4	3	1910	7/16	4	542	9/16	6	221
1/4	3 1/2	1585	7/16	4 1/2	503	9/16	6 1/2	200
1/4	4	1326	7/16	5	461	9/16	7	190
1/4	4 1/2	1223	7/16	5 1/2	423	9/16	7 1/2	180
1/4	5	1025	7/16	6	402	9/16	8	170
5/16	3	1010	7/16	6 1/2	321	9/16	8 1/2	160
5/16	3 1/2	963	1/2	5	340	9/16	9	150
5/16	4	810	1/2	5 1/2	312	9/16	10	140
5/16	4 1/2	605	1/2	6	298	5/8	8	140
5/16	5	583	1/2	6 1/2	280	5/8	9	120
5/16	6	521	1/2	7	261	5/8	10	110
			1/2	7 1/2	240	5/8	11	100
			1/2	8	223	3/4	10	80
						3/4	15	60

RAILROAD SPIKES.

Size, Length, Inches.	Thick, Inch.	No. in 100 lbs.	Size, Length, Inches.	Thick, Inch.	No. in 100 lbs.
4 1/2	7-16	351	5 1/2	1/2	237
4 1/2	1/2	267	5 1/2	9-16	193
5	5/8	473	5 1/2	5/8	146
5	7-16	326	6	1/2	207
5	1/2	260	6	9-16	175
5	9-16	197	6	5/8	131
5	5/8	172			

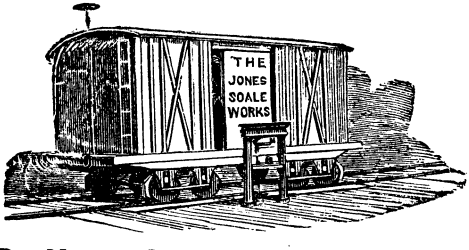
Hosted by Google

Only One Moment of Your Time.

We sell direct to the user, saving to him from one to three profits.
We make the best Scale, and so warrant.
EVERY SCALE SOLD ON TRIAL.
The purchaser to be satisfied or no sale, and he to be the judge.
WE HAVE BUT ONE PRICE.
Order by mail, and decline to be bored by agents.

THE JONES SCALE WORKS,

BINGHAMTON, - NEW YORK.



Railroad Scales

OF EVERY KIND

A Specialty.

6 Ton Hay Scales,	$125.00	2500 lbs. Portable, on wheels,	$50.00
5 " " "	100.00	1250 " " " "	30.00
4 " " "	87.50	600 " " " "	22.50

240 lbs. Union, - - - - $9.00.

☞ *MAXIM.—Receive with caution the statement of any one whose* INTEREST *it is to* DECEIVE *you regarding the quality of our Scales.*

Hosted by Google

Emery Wheels.

Champlin & Rogers.....Chicago, Ill.. .....See Page 192
D. Brewer & Co..... .....Philadelphia, Pa..... " 246

Engine Builders—Steam.

Buffalo Machinery Agency.....Buffalo, N. Y.....See Page 160
C. Henry Hall & Co..... .....New York..... " 4
Erie City Iron Works.....Erie, Pa..... " 170
J. B. Waring..... .....New York..... " 24
J. S. Mundy ....Newark, N. J..... " 266
See also, Steam Engines.

Engine Lathes.

Isaac H. Shearman..... .....Philadelphia, Pa.....See Page 80
Phelps & Sanger.....Cleveland, Ohio..... " 120

Engine Trimmings.

J. J. Walworth.....Chicago, Ill.....See Page 174
J. G. Knapp Manufacturing Co..... .....New York..... " 16

Engineers.

Phillipsburg Manufacturing Co..... New York.....See Page 22

Engineers' Instruments.

F. Eckel.....New York.....See Page 76
Kuebler & Seelhorst.....Philadelphia, Pa... ..... " 216
Wm. J. Young & Sons..... " " ..... " 138

Engineers Stationery Materials.

Charles F. Ketcham.....New York.....See Page 262

Engines.

The Atlas Works.....Pittsburgh, Pa.....See Page 172

Engravers.

Chas. F. Ketcham.....New York.....See Page 262
Mathieson & Schrader..... ..... New York..... " 82
Warren, Johnson & Co... .....Buffalo, N. Y..... " 100

SPECIFIC GRAVITY AND WEIGHT OF METALS AND ALLOYS.

	Specific Gravity.	Weight of a Cubic Foot. Lbs.	Weight of a Cubic Inch. Lbs.
Aluminium, cast.....	2560	160	.092
Antimony, cast.....	6710	419	.243
Arsenic.....	5760	.....	.208
Bismuth, cast.....	9822	613	.353
Brass, cast.....	7800	500	.280
	8400	527	.304
Brasss, Rolled.....about.	8300	525	.302
Bronze (Copper 8, Tin 1) Gun Metal, about.	8460	528	.305
Copper, cast	8750	543	.315
" , rolled.....	8800	548	.317
" , wire.....	8850	553	.321
Gold, pure, cast, 24 carat.....	19258	1204	.696
" " hammered, 24 carat.....about.	19500	1217	.702
Iron, cast, purest is common average	7210	450	.260
" wrought heaviest " "	7770	485	.280
Lead, cast.....	113 0	708	.408
" rolled.....	11410	712	.411
Mercury— 40°.....	15630	978	.566
" 32°.....	13610	848	.492
" 60°.....	13580	846	.490
" 212°.....	13375	836	.483
Nickel, Plate.....	8800	5 9	.318
Platinium, hammered .....about.	21500	1343	.775
" native, in grains..... " .	17500	.....	.....
Silver, pure, cast.....	10474	654	.378
" " hammered	10510	655	.379
Steel (Carbon lightens it) common average.	7850	490	.283
Tin (common average).....	7291	455	.262
Zinc " "	7000	437	.252

Hosted by Google

L. G. TILLOTSON & CO.

MANUFACTURERS, IMPORTERS and DEALERS IN

RAILWAY

AND

TELEGRAPH SUPPLIES.

NO. 8 DEY STREET, NEW YORK.

SPECIAL AGENTS AND REPRESENTATIVES OF

The Combination Car Spring Company.
New Haven Car Company.
New Haven Car Head Lining Works.
Buffalo Steam Gauge Company.
Mansfield Elastic Frog Company.
Mercer Rubber Company.
Hamilton Rubber Works.
Pickering's Pulley Blocks.

MANUFACTURERS OF ALL KINDS OF

RAILWAY TRIMMINGS

AND

TELEGRAPH SUPPLIES.

KEEP IN STORE FULL LINE OF ALL MATERIAL FOR

RAILWAY CONSUMPTION.

Hosted by Google

Exhaust Nozzles.

Geo. W. Richardson & Co.....Troy, N. Y.....See Page 50

Extra Irons.

J. T. Ryerson.....Chicago, Ill.....See Page 180

Factory Bells.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116

Feather Brushes.

Vose, Dinsmore & Co.....New York.....See Page 60

Fellys.

Wm. Green & Co.....Wilmington, Del.....See Page 248

Felt.

H. W. Johns.....New York.....See Page 224
Vose, Dinsmore & Co..... " " ..... " 60

Felting.

Crane Bros. Manufacturing Co.....Chicago, Ill.....See Page 230

Files.

England & Bindley.....Pittsburgh, Pa.....See Page 162
G. & H. Barnett.....Philadelphia, Pa..... " 216
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Hermann Boker & Co.....New York.....See Pages 152, 154
Pratt & Co.....Buffalo, N. Y.....See Page 132
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138
Tyng & Co.....New York..... " 260

SPECIFIC GRAVITY AND WEIGHT OF WOOD.

	Specific Gravity.	Weight of a Cubic Foot. Lbs.	Weight of 1'00 Feet Board Measure. Tons.
Apple	793	49.56	
Ash	752	47.	1.748
" , American White	610	38.	1.414
Beech	690	43.	
Birch	567	35.	
Boxwood	960	60.	
Cherry	672	42.	1.562
Chesnut	550	41.	1.525
Cork	250	15.6	
Dogwood	756	47.	
Ebony, Indian	1209	75.5	
Elm	560	35.	1.302
Fir	512	32.	
Hazel	860	53.7	
Hawthorn	910	56.8	
Hemlock	400	25.	.930
Hickory	850	53.	1.971
Lignum-Vitæ	1333	83.4	
Locust	728	45.5	
Logwood	913	57.	
Mahogony, Spanish	852	53.2	
" , Honduras	560	35.	
Maple	750	46.8	
" , Birds' Eye	576	36.	
Oak, English	777	48.	
" , White	780	49.	
" , Live	950	59.	
" , Red	850	53.	
Pine, White ....average	400	25.	.930
" , Yellow, North, "	550	34.3	1.279
" , " South, "	720	45.	1.674
Poplar	5 7	36.6	
Satinwood	885	55.3	
Spruce	400	25.	.930
Sycamore	590	37.	1.376
Walnut, Black	610	38.	1.414
Willow	585	36.5	

Hosted by Google

The Leclanche Battery,

40 West 18th Street, New York.

(Secured by Letters Patent in the United States.)

TELEGRAPHY,

RAILROAD SIGNALS,

HOTEL ANNUNCIATORS,

BELLS, ETC.

Adopted in France by the "Paris, Lyons and Mediterranean," the "Northern," the "Middle," the "Western," and the "Eastern" Railroad Companies. In England, in Austria, in Belgium, in Holland and in Italy.

The Positive Pole is composed of a plate of Carbon set into a mixture of powdered per Oxide of Manganese and Carbon, and hermetically sealed in a porous vase.

The Negative Pole is composed of a plate or pencil of amalgamated Zinc.

The two Poles are set in a solution of Sal Ammoniac and water, contained in a glass jar.

As the Zinc is indefinitely preserved without alteration in the Sal Ammoniac, and as the per Oxide of Manganese is insoluble in this liquid, no internal chemical action takes place when not in use.

The Electro-motive power of Grove being 100, this is 75, and Daniels 50; or three cells of this battery are equal to four cells of the Daniels.

ITS ADVANTAGES MAY BE ENUMERATED AS FOLLOWS:

1st. Running Expenses Reduced to a Minimum,

2d. The entire Absence of Acids.

3d. Its Great Cleanliness.

4th Impossibility of Getting Out of Order.

5th Does not Freeze.

6th. Will Last without Renewal from one month to several years, according to use, at the end of which time the porous cells can be renewed at a moderate cost.

☞ A number of cups have been in use by the Western Union Telegraph Company, *on a closed circuit*, since November 26, 1872, nothing but water having been added since they were first set up.

For further particulars, &c., apply to

THE LECLANCHE BATTERY CO.

No. 40 West 18th Street, New York.

Or to L. G. TILLOTSON & CO., Sole Agents, No. 8 Dey St.

Hosted by Google

Fire Brick.

Hall & Sons	Buffalo, N. Y	See Page 254
Maurer & Weber	New York	" 228
Philip Neukumet	Philadelphia, Pa	" 104
Rogers & Co	Chicago, Ill	" 144
Star Fire Brick Co	Pittsburgh, Pa	" 232
Van Tuyl Manufacturing Co	New York	" 242

Fire Buckets.

Darrow, Turner & Co	New York	See Page 62

Fire Clay.

Rogers & Co	Chicago, Ill	See Page 144

Fire Engines.

Charles B. Hardick	Brooklyn, N. Y	See Page 84

Fish Bars.

Hermann Boker & Co	New York	See Pages 152, 154
Jones & Laughlins	Pittsburgh, Pa	See Page 32

Fish Plates.

Collier & Scranton ; Oxford Iron Co	New York	See Page 122
G .B. Walbridge	" "	" 130
Greene & Randolph	" "	" 54
Lock Nut & Bolt Co. of New York	" "	" 272
O. W. Child	" "	" 262
Tyng & Co	" "	" 260

Flags.

De Grauw, Aymar & Co	New York	See Page 112

Flange Pipes.

R. A. Brick & Co	New York	See Page 48

SHAFTS AND WELLS.

(*Condensed from Trautwine.*)

Diam. in Feet.	For Shafts. Cubic yds. of Digging.	For Wells. No. Bricks in lining 1 br'k thick.	For Wells. Conts. in Gals.
3	.262	170	.367
½	.356	198	.499
4	.465	227	.653
½	.589	255	.826
5	.727	283	1.02
½	.880	311	1.234
6	1.047	340	1.47
½	1.229	368	1.724
7	1.425	396	2.
½	1.636	425	2.295
8	1.862	453	2.611
7/16	2.102	481	2.948
9	2.356	509	3.305
½	2 625	538	3.682
10	2.91	566	4.08
½	3.207	594	4.498
11	3.52	622	4.937
½	3.847	651	5.396
12	4.19	679	5.875
½	4.54	707	6.375
13	4.916	736	6.895
½	5.3	764	7.436
14	5.7	792	7.997
½	6.116	820	8.578
15	6.545	849	9.18
½	6.99	877	9.8
16	7.447	9 5	10.44
½	7.92	933	11.11
17	8.407	962	11.8
½	8.908	990	12.5
18	9.425	1018	13.22
½	9.95	1046	13.96
19	10.5	1075	14.73
½	11.06	1103	15.51
20	11.64	1131	16.32
½	12.22	1160	17.15
21	12.83	1188	18.
½	13.45	1216	18.85
22	14.08	1244	19.75
½	14.73	1273	20.66
23	15.39	1301	21.58
½	16.06	1329	22.53
24	16.76	1357	23.5
25	18.18	1414	25.5

For Shafts, or for cubic yards of digging for Wells, take the diameter of the digging; for diameters greater than given, take a given size ½ the required one, and multiply the quantity by 4; thus, for 40 feet take 11.61 (for 20 feet), multiply by 4 = 46.56 cub c yards.

For Wells, take the diameter in clear of lining, and for bricks in larger sizes take double the quantity given above for ½ the required size; the brick lining will be 8¼ inches thick; for gallons, take diameter inside of lining, and for larger diameters, observe same rule as given above for cubic yards of digging.

Hosted by Google

DeLaney & Co.

BUFFALO, NEW YORK.

NIAGARA FORGE WORKS.

FINISHED and ROUGH, MARINE and STATIONARY ENGINE, RAILROAD ENGINE, and CAR FORGINGS.

HAMMERED SCRAP **AXLES** A SPECIALTY

Iron first prepared under a TEN-TON hammer.

AXLES CENTERED READY FOR LATHES,
AND
DATED MONTH AND YEAR OF MANUFACTURE.

Cheapest and Best Hammered Axle Sold.

☞ References cheerfully given.

(ESTABLISHED IN 1850.)

W. P. KELLOGG & CO.

TROY, N. Y., and 118 Chambers St., NEW YORK.

"The Empire"

A FAN BLOWING PORTABLE FORGE,

FOR RAILROADS, QUARRIES, MINES, MACHINE AND BOILER SHOPS,

Is the best, most durable, simplest, cheapest and most effective forge ever made.

ALSO

Boring Machines, Mortising Machines,

SCALES, CURRY COMBS and HARDWARE SPECIALTIES.

☞ SEND FOR A CIRCULAR.

Hosted by Google

Flue Iron.

Wm. Green & Co.....Wilmington, Del.....See Page 248

Fog Signals—Torpedo.

Tyng & Co.....New York.....See Page 260

Foot Lathes.

Phelps & Sanger.....Cleveland, Ohio.....See Page 120
See also Lathes.

Force Pumps.

A. Carr.....New York.....See Page 244
C. Henry Hall & Co..... " " ..... " 4
Vose, Dinsmore & Co..... " " ..... " 60

Forge Bellows.

Geo. Worthington & Co.....Cleveland, Ohio.....See Page 100
Joseph Churchyard.....Buffalo, N. Y..... " 160
Newcomb Bro's. Sons.....New York..... " 88

Forges.

John Bayliss.....New York.....See Page 76
Newcomb Bro's. Sons..... " " ..... " 88
S. S. Townsend..... " " ..... " 2
Wm. B. Bement & Son.....Philadelphia, Pa..... " 168
W. P. Kellogg & Co.....Troy, N. Y..... " 98

VALUE OF IRON.

Value per Gross Ton (2240 lbs.) of IRON, at from 1-16th of a cent to 10 cents per Pound, increasing at Rate of 1-16th and 1-8th of a cent per Pound.

Per lb. in cts. & 1-16ths.	Price per Ton.	Per lb. in cts. & 1-16ths.	Price Per Ton.	Per lb. in cts. & 1-8ths.	Price per Ton.
1-16	$ 1.40	2 5-8	$58.80	2-8	$165.20
1-8	2.80	11-16	60.20	1-2	168.
3-16	4.20	3-4	61.60	5-8	170.80
1-4	5.60	13-16	63.	3-4	173.60
5-16	7.	7-8	64.40	7-8	176.40
3-8	8.40	15-16	65.80	8	179.20
7-16	9.80	3	67.20	1-8	182.
1-2	11.20	1-8	70.	1-4	184.80
9-16	12.60	1-4	72.80	3-8	187.60
5-8	14	3-8	75.60	1-2	190.40
11-16	15.40	1-2	78.40	5-8	193.20
3-4	16.80	5-8	81.20	3-4	196.
13-16	18.20	3-4	84.	7-8	198.80
7-8	19.60	7-8	86.80	9	201.60
15-16	21.	4	89.60	1-8	204.40
1	22.40	1-8	92.40	1-4	207.20
1-16	23.80	1-4	95.20	3-8	210.
1-8	25.20	3-8	98.	1-2	212.80
3-16	26.60	1-2	100.80	3-4	218.40
1-4	28.	5-8	103.60	10	224.
5-16	29.40	3-4	106. 0	1-8	226.80
3-8	30.80	7-8	109.20	1-4	229.60
7-16	32.20	5	112.	3-8	232.40
1-2	33.60	1-8	114.80	1-2	235.20
9-16	35.	1-4	117.60	5-8	238.
5 8	36.40	3-8	120.40	3-4	240.80
11-16	37.80	1-2	123.20	7-8	243.60
3-4	39.20	5-8	126.	11	246.40
13-16	40.60	3-4	128.80	1-8	249 20
7-8	42.	7-8	131.60	1-4	252
15-16	43.40	6	134.40	3-8	254.80
2	44.80	1-8	137.20	1-2	257.60
1-16	46.20	1-4	140.	5-8	260 40
1-8	47.60	5-8	142.80	3-4	263.20
3-16	49.	1-2	145.60	7-8	266.
1-4	50.40	5-8	148.40	12	268.80
5-16	51.80	3-4	151.20	1-8	271 60
3-8	53.20	7-8	154.	1-4	274.40
7-16	54.60	7	156.80	3-8	277 20
1-2	56.	1-8	159.60	1-2	280.
9-16	57.40	1-4	162.40		

Hosted by Google

WORLD'S PRIZE MEDALS.

F. S. PEASE'S
IMPROVED RAILROAD OILS

PRIZE MEDALS:

LONDON, 1862. PARIS, 1867.

AMERICAN INSTITUTE, 1856, 1867.

GOLD MEDAL, - - UNITED STATES.

ENGINE, SIGNAL, LARD, VALVE, COACH OILS, "PREMIUM PETROLEUM" and HEAD LIGHT OILS,

Endorsed by experience and tests of years, and the highest authority of the United States and Europe.

65 & 67 Main Street; 82, 84 & 86 Washington St. } **BUFFALO, N. Y.** { LONDON, ENG.

GEO. WORTHINGTON & CO.
HARDWARE MERCHANTS,

WHOLESALE DEALERS IN

Builders' Hardware, Machinists' Tools, Mining Supplies, Tinners' Goods, Metals, Iron, Steel and Nails.

Nos. 90 & 92 Water St., Cleveland, Ohio.

Courier Company's Fire-Proof Show Printing House.

WARREN, JOHNSON & CO.

197 Main and 202 & 204 Washington Sts., BUFFALO, N. Y.

Printers, Publishers, Stationers, Blank Book Manufacturers and Engravers.

Blanks, Blank and Copying Books and Railroad Stationery

OF ALL DESCRIPTIONS.

CONSECUTIVELY NUMBERED RAILROAD TICKETS,

LOCAL AND COUPON.

Agents for Davidson's Celebrated Burglar and Fire-Proof Safes.

☞ ORDERS SOLICITED AND ESTIMATES PROMPTLY FURNISHED.

Hosted by Google

Forgings.

DeLaney & Co.....Buffalo, N. Y.....See Page 98
Pittsburgh Forge & Iron Co.....Pittsburgh, Pa..... " 174

Founders.

Snyder Bros.....Williamsport, Pa.....See Page 46

Founders' Tools.

S. S. Townsend.....New York.....See Page 2

Foundry Facings.

Van Tuyl Manufacturing Company.....New York.....See Page 242

Foundry Fixtures.

Wm. B. Bement & Son.....Philadelphia, Pa.....See Page 168

Foundry Supplies.

Van Tuyl Manufacturing Co.....New York.....See Page 242

Freight Cars.

Chas. W. Matthews.....Philadelphia, Pa.....See Page 38
Greene & Randolph.....New York..... " 54
O. W. Child..... " " ..... " 262
See also, Car Builders.

Frogs.

Anderson & Woods.....Pittsburgh, Pa.....See Page 150
L. G. Tillotson & Co.....New York..... " 94
O. W. Child..... " " ..... " 262
Pittsburgh Bolt Co.....Pittsburgh, Pa..... " 118
Skinner & Gifford Manufacturing Co.....Dunkirk, N. Y..... " 140
The Atlas Works.....Pittsburgh, Pa..... " 172

VALUE OF IRON.

Value per Gross Ton (2240 *lbs.*) *of IRON at from* 1-10*th of a cent to* 10 *cents per Pound, increasing at Rate of* 1-10*th of a cent per Pound.*

Per lb. in cts. & 1-10ths.	Price per Ton.	Per lb. in cts. & 1-10ths.	Price per Ton.	Per lb. in cts. & 1-10ths.	Price per Ton.
1-10	$ 2.24	3 5-10	$ 78.40	6 8-10	$152.32
2-	4.48	6-	80.64	9-	154.56
3-	6.72	7-	82 88	7	156.80
4-	8.96	8-	85.12	1-10	158.04
5-	11.20	9-	87.36	2-	161.28
6-	13.44	4	89.60	3-	163.52
7-	15.68	1-10	91.84	4-	165.76
8-	17.92	2-	94.08	5-	168.
9-	20 16	3-	96.32	6-	170.24
1	22.40	4-	98 56	7-	172.48
1-10	24.64	5-	100.80	8-	174.72
2-	26.88	6-	103.04	9-	176.96
3-	29.12	7-	105 28	8	179.20
4-	31.36	8-	107.52	1-10	181.44
5-	33.60	9-	109.76	2-	183.68
6-	35 84	5	112.00	3-	185.92
7-	38.08	1-10	114.24	4-	188.16
8-	40.32	2-	116.48	5-	190.40
9-	42.56	3-	118.62	6-	192.64
2	44.80	4-	120.96	7-	194.88
1-10	47.04	5-	123.20	8-	197.12
2-	49.28	6-	125.44	9-	199.36
3-	51.52	7-	127.68	9	201.60
4-	53.76	8-	129 92	1-10	203.84
5-	56.	9-	132.16	2-	206 08
6-	58.24	6	134.40	3-	208.32
7-	60.48	1-10	136.64	4-	210.56
8-	62.72	2-	138.88	5-	212 80
9-	64.96	3-	141.12	6-	215 04
3	67.20	4-	143.36	7-	217.28
1-10	69.44	5-	145.60	8-	219.52
2-	71.68	6-	147.84	9-	221.76
3-	73.92	7-	150.08	10	224.
4-	76.16				

Hosted by Google

E. A. C. DU PLAINE. PAUL S. REEVES.

TUBAL SMELTING WORKS,

No. 760 So. Broad St., PHILADELPHIA.

DU PLAINE & REEVES,

Brass Founders and Smelters

Anti-Friction or Babbitt Metals.

XXX METAL, Nick. Hardening, 55c.
XX " " " 50c.
X " **Copper** " 45c.

Guaranteed to contain no lead.

A METAL. 40c. **B METAL.** 35c.
C " 30c. **D** " 25c.
E METAL. 20c.

These metals contain a very large per centage of tin, antimony, and copper hardening, according to price.

F METAL. 18c. **G METAL.** 16c
H " 14c. **J** " 12c.

These metals are the ordinary low-priced Babbitt Alloys, used where there is not much wear on the machinery, and where economy is required. They are *superior* to the higher-priced metals of other markets.

Brass Castings.

ENGINE BRASS, ROLLING MILL BRASS, PACKING RINGS, &c.
First quality metals, warranted new, (copper and tin.)

ORDINARY RED BRASS CASTINGS,
of superior metals, (part new, part old.)

GOOD QUALITY RED BRASS CASTINGS,
from well selected old metal.

No. 1, Yellow Brass Castings, all new metal.
" **2, Yellow Brass Castings.**
" **1, Car-Journal Boxes,** new metal.
" **2, Car-Journal Boxes,** one-half new, one-half old metal.
" **3, Car-Journal Boxes,** good old metal.
" **4, Car-Journal Boxes,** common metal.

Ingot, or Pig Brass

We manufacture this material for Brass Founders and Manufacturers, who prefer to do their own Casting; and will supply them at lower rates than they can purchase elsewhere. A written guarantee given with all purchases, if desired, of new metal, subject to analysis at our cost, if not as represented.

10 Parts Copper to 1 Tin. **8 Parts Copper, to 1 Tin,** } New
9 " " **1** " **7** " " **1** " }
6 Parts Copper to 1 Tin, } Metal.

The same mixtures from well-selected old metal, with part new copper and tin added to restore it.

Ordinary Red Brass, no new metal in pig.
No. 1. Yellow Brass, new metal, 1½ to 4 parts of Copper to 1 of Spelter, in pig or ingots, warranted.
No. 2. Yellow Brass, old and new mixed.
No. 3. All Old Yellow Brass, mixed.

☞ *SEND FOR PRICE LIST.*

Hosted by Google

Frog Signals.

L. G. Tillotson & Co.....New York.....See Page 94
Tyng & Co..... ..... " " ..... " 260

Furnaces.

Newcomb Brother's Sons.....New York.....See Page 88

Furniture.

A. L. Hale & Brother.....Chicago, Ill.....See Page 206

Fuses.

Geo. W. Mowbray.....North Adams, Mass.....See Page 182
F. M. Alford.....Avon, Conn..... " 158
Laflin & Rand Powder Co.....New York.....See Last Page

Galvanized Iron.

Bruce & Cook..... .....New York.....See Page 112
John Merry & Co..... ..... " " ..... " 48
Marshall Lefferts, Jr..... " " ..... " 44
Tyng & Co..... " " ..... " 260

Galvanized Nails.

John Merry & Co..... .....New York.....See Page 48
Marshall Lefferts, Jr..... " " ..... " 44

CONTENTS OF CYLINDERS AND PIPES.

In Cubic Feet and Gallons.

(Condensed from Trautwine.)

Diameter in Ins.	For 1 Foot in length. Cubic Feet.	Gallons of 231 Cub. Ins.	Diameter in Ins.	For 1 Foot in length. Cubic Feet.	Gallons of 231 Cub. Ins.	Diameter in Ins.	For 1 Foot in length. Cubic Feet.	Gallons of 231 Cub. Ins.
1/4	.0003	.0025	4	.0873	.6528	10	.5454	4.08
3/8	.0005	.004	1/4	.0985	.7369	1/4	.573	4.286
1/16	.0008	.0057	1/2	.1104	.8263	1/2	.6013	4.498
1/8	.001	.0078	3/4	.1231	.9206	3/4	.6303	4.715
3/16	.0014	.0102	5	.1364	1.02	11	.66	4.937
1/2	.0017	.0129	1/4	.1503	1.125	1/4	.6903	5.164
9/16	.0021	.0159	1/2	.165	1.234	1/2	.7213	5.396
5/8	.0026	.0193	3/4	.1803	1.349	3/4	.753	5.633
11/16	.0031	.0230	6	.1963	1.469	12	.7854	5.875
3/4	.0036	.0269	1/4	.2131	1.594	1/2	.8522	6.375
13/16	.0042	.0312	1/2	.2304	1.724	13	.9218	6.895
7/8	.0048	.0359	3/4	.2485	1.859	1/2	.994	7.436
15/16	.0055	.0408	7	.2673	1.999	14	1.069	7.997
1	.0085	.0638	1/4	.2867	2.145	1/2	1.147	8.578
1/4	.0123	.0918	1/2	.3068	2.295	15	1.227	9.180
1/2	.0167	.1249	3/4	.3276	2.45	1/2	1.31	9.801
3/4	.0218	.1632	8	.3491	2.611	16	1.396	10.44
2	.0276	.2066	1/4	.3712	2.777	1/2	1.485	11.11
1/4	.0341	.255	1/2	.3941	2.948	17	1.576	11.79
1/2	.0412	.3085	3/4	.4176	3.125	1/2	1.67	12.49
3/4	.0491	.3672	9	.4418	3.305	18	1.767	13 22
3	.0576	.4309	1/4	.4667	3.491	1/2	1.867	13.96
1/4	.0668	.4998	1/2	.4922	3.682	19	1.969	14.73
1/2	.0767	.5738	3/4	.5185	3.879	1/2	2.074	15.51
3/4						20	2.182	16.32

To find the contents of a larger pipe than given above, take one-half the size and multiply by 4, or take one-fourth the size aud multiply by 16. Thus: wanted, the contents of a pipe 30 inches in diameter; 9.180 (contents of 15 inch pipe) × 4 = 36.72 gallons. Wanted, contents of a pipe 50 inches in diameter; .8522 (contents of 12½ inch pipe) × 16 = 13.6352 cubic inches.

Hosted by Google

PHILADELPHIA AND KENSINGTON

23d & VINE STREETS, - PHILADELPHIA.

PHILIP NEUKUMET, Proprietor.

(Successor to John Neukumet,)

MANUFACTURER OF

Fire Bricks, Blocks AND Tiles,

FOR

Rolling Mills, Gas Works, Blast Furnaces, Foundries, Lime Kilns, Glass Works, &c.

SPECIAL ATTENTION PAID TO

TILES for LOCOMOTIVES,

ACCORDING TO DRAWING OR PATTERN, AND

Edge Pressed Blocks for Blast Furnaces.

☞ BLOCKS or TILES of any Size or Shape *Made to Order*, at the Shortest Notice, and of Superior Quality. ☜

Fire Clay, Ground Brick, Fire Mortar, Kaolin, &c.,

CONSTANTLY ON HAND.

Hosted by Google

Galvanized Pipe.

Evans, Dalzell & Co.....Pittsburgh, Pa.....See Page 58
Morris, Tasker & Co.....Ph ladelphia, Pa..... " 36

Galvanizers.

ohn Merry & Co.....New York.....See Page 48
Marshall Lefferts, Jr..... " " ..... " 44

Galvanometers.

Charles T. Chester.....New York.....See Page 212
Geo. H. Biss & Co.....Chicago, Ill ..... " 164
Leclanche Battery Co.....New York..... " 96

Gas Apparatus.

Morris, Tasker & Co.....Philadelphia, Pa.....See Page 36

Gas and Steam Fittings.

. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116
Crane Bros. Manufacturing Co.....Chicago, Ill..... " 230
McNab & Harlin Manufacturing Co.....New York..... " 220
Morris, Tasker & Co.....Philadelphia, Pa..... " 36
Pancoast & Maule..... " " ..... " 26

FALLING BODIES.

Velocity Due to Different Heights (Approximate.)

(Molesworth.)

Fall in feet.	Velocity. Feet per second.	Fall in feet.	Velocity. Feet per second.	Fall in feet.	Velocity. Feet per second.
1	8	50	57	275	133
2	11.3	60	62	300	139
3	13.9	70	67	325	144
4	16	80	72	350	150
5	18	90	76	375	155
10	25	100	80	400	160
15	31	125	90	450	170
20	36	150	98	500	179
25	40	175	106	550	188
30	44	200	113	600	196
35	47	225	120	800	227
40	51	250	127	1000	254

RIVETED COPPER PIPES.

Weight of One Running Foot.

Including the necessary laps for riveting or calking, but not including weight of rivets, which will, of course, vary according to number and sizes used, in proportion to thickness of metal.

Diam. Inch.	Thickness, in Inches. 1/8	3/16	1/4	5/16
5	8.16	12.25	16.30	
5½	8.9	13.35	17.8	
6	9.65	14.5	19.3	
6½	10.5	15.7	20.9	
7	11.2	16.8	22.4	
7½	12.	18.	24.	
8	12.6	19.1	25.5	
8½	13.5	20.2	27.	
9	14.3	21.5	28.6	
9½	15.	22.5	30.1	
10	16.	24.	32.	40.
10½	—	25.2	33.5	41.8
11	—	26.3	35.	43.7
12	—	28.5	38.	47.5
13	—	31.2	41.5	51.8
14	—	33.2	44.3	55.4

Diam. Inch.	Thickness, in Inches. 3/16	1/4	5/16
15	35.5	47.2	59.3
16	37.8	50.5	62.9
17	39.8	53.2	66.5
18	42.4	56.5	70.5
19	44.7	59.5	75.
20	—	62.6	78.
21	—	66.	82.5
22	—	69.2	86.5
23	—	72.3	90.2
24	—	75.5	93.6
25	—	78.7	97.5
26	—	80.2	100.5
27	—	83.6	104.5
28	—	86.8	108.5
29	—	90.2	112.7
30	—	92.4	116.

Hosted by Google

H. N. WINANS,
New York.

I. D. POLLARD,
Birmingham, Eng

WINANS & CO.

Commission Merchants,

AND

HYDRAULIC ENGINEERS,

Office, 11 Wall St., P. O. Box 6, New York.

☞ NOTICE OF LOCATION OF WAREHOUSE HEREAFTER. ☜

Importers of Every Description of English Machinery,

BOILER TUBES AND PIPING A SPECIALTY.

—ALSO,—

Hydraulic Machinery.

Mining Machinery, Railway and Engineers' Supplies,

AMERICAN and FOREIGN,

ON SALE OR TO ORDER, AT SHORT NOTICE AND FAIR PRICES.

STEAM AND PORTABLE TRAVELING CRANES.
PIG IRON AND BLOOMS, Scotch and Staffordshire.
CAST STEEL FORGINGS, STEEL AXLES and TYRES.
STEEL AND IRON BOILER PLATES.
IRON AND STEEL RAILS, New and Old.
MORTAR MILLS, GAUGE GLASSES, COTTON WASTE.
INJECTORS AND WATER ELEVATORS, &c., &c.

REFERENCES:

JOHN C. WINANS, President Hamilton Insurance Company.
HENRY MORGAN, of Matthew Morgan's Sons.
J. LLOYD ASPINWALL, of Howland & Aspinwall.

TANGYE BROS. & Co., Birmingham.
TAUNTON & HAYWARD, do.
KITCHING BROTHERS, Leeds.

Hosted by Google

Gas and Steam Fitters' Tools.

Champlin & Rogers	Chicago, Ill	See Page 192
Crane Bros. Manufacturing Co	" "	" 230
McNab & Harlin Manufacturing Co	New York	" 220
Morris, Tasker & Co	Philadelphia, Pa	" 36
Nelson Tool Works	New York	" 30
Pancoast & Maule	Philadelphia, Pa	" 26
Phelps & Sanger	Cleveland, Ohio	" 120

Gas Pipe.

A. Carr	New York	See Page 244
Evans, Dalzell & Co	Pittsburgh, Pa	" 58
J. J. Walworth	Chicago, Ill	" 124
J. T. Ryerson	" "	" 180
Morris, Tasker & Co	Philadelphia, Pa	" 36
Phelps & Sanger	Cleveland, Ohio	" 120
R. A. Brick & Co	New York	" 48
Winans & Co	" "	" 106
Wm. Graff & Co	Pittsburgh, Pa	" 174

Gauges.

Buffalo Steam Gauge Co	Buffalo, N. Y	See Page 170
J. G. Knapp Manufacturing Co	New York	" 16
McNab & Harlin Manufacturing Co	" "	" 220

Gauge Tubes.

J. J. Walworth	Chicago, Ill	See Page 124

Geared Foot Lathes.

Wm. Sellers & Co	Philadelphia, Pa	See Page 64

FLAT IRON.

Number of Feet in a Bundle of 112 *Pounds.*

Size.	Feet in Bundle.	Size.	Feet in Bundle.
1-2 by 1-4 Inch.	267	7-8 by 1-4 Inch.	155
1-2 " 5-16 "	216	7-8 " 5-16 "	122
1-2 " 3-8 "	175	7-8 " 3-8 "	100
5-8 " 1-4 "	214	7-8 " 7-16 "	90
5-8 " 5-16 "	170	7-8 " 1-2 "	75
5-8 " 3-8 "	145	7-8 " 5-8 "	60
5-8 " 1-2 "	106	1 " 1-4 "	135
3-4 " 1-4 "	175	1 " 5-16 "	106
3-4 " 5-16 "	142	1 " 3-8 "	90
3-4 " 3-8 "	120	1 " 7-16 "	78
3-4 " 7-16 "	103	1 " 1-2 "	65
3-4 " 1-2 "	90	1 " 9-16 "	60
3-4 " 5-8 "	70	1 " 5-8 "	52

ROUND AND SQUARE IRON.

Number of Feet in a Bundle of 112 *Pounds.*

Round Iron. Size.	Feet in Bundle.	Square Iron. Size.	Feet in Bundle.
3-16 Inch.	1 15	3-16 Inch.	958
1-4 "	688	1-4 "	540
5-16 "	440	5-16 "	345
3-8 "	305	3-8 "	240
7-16 "	225	7-16 "	176
1-2 "	170	1-2 "	135
9-16 "	136	9-16 "	107
5-8 "	110	5-8 "	87
11-16 "	90	11-16 "	70
3-4 "	75	3-4 "	60

PULLEYS OR BLOCKS.

A movable pulley reduces the necessary amount of power, in the proportion of 2 to 1 for every wheel in the pulley; thus, a movable pulley with 1 wheel will reduce the power one-half, 2 wheels to one-fourth, 3 wheels to one-sixth, etc.

Hosted by Google

1855 to 1873.

H. N. WINANS'

Anti-Incrustation Powder,

FOR CLEANING STEAM BOILERS.

11 WALL STREET, or P. O. BOX 6,

NEW YORK.

This valuable invention has been in successful operation **18 YEARS**, which *fact alone* proves its **Utility, Safety and Cheapness.**

Cost 35 Cents per Lb., or 10 to 20 Cents a Day.

☞ BEWARE OF NUMEROUS IMITATIONS AND FRAUDS. ☜

R. Aleshire & Co., Gallipolis, Ohio, January, 1873, say: Our engineer has "*graduated*," got enough of new powders, and returns to his "first love"; therefore, send another barrel at once.

This article is guaranteed to keep a boiler *permanently clean* as long as properly and persistently used, and is sure to effect a saving of three times its cost; the least possible crust, say 1-16 inch, compels a waste of 15% of fuel; of course this excess of heat destroys the bottom plates of the boiler, invites corrosion, repairs, and probable *explosions.*

☞ References by the Thousand, almost Anywhere. ☜

Gaylord & Co., Portsmouth, Ohio, running 12 boilers, have used it steadily 15 years—2500 to 3000 pounds a year, one barrel a month.

What better evidence is needed of VALUE, ECONOMY and SAFETY.

Largely Sold in China, Cuba, California, Chili, Peru, Brazil, and the United States generally.

Hosted by Google

Girders.

Rogers & Co.....Chicago, Ill.....See Page 144

Glass Bearings.

John Harden.....New York.....See Page 230

Glass Letters.

Jay & Cook.....New York.....See Page 234

Glass—Looking.

D. R. Hobart & Co.....New York.....See Page 126
Jay & Cook..... " " ..... " 234
Leffingwell & Co.....Cleveland, Ohio..... " 190

Glass—Ornamented.

D. R. Hobart & Co.....New York.....See Page 126
Jay & Cook..... " " ..... " 234
Leffingwell & Co.....Cleveland, Ohio..... " 190

Glass—Plate.

D. R. Hobart & Co.....New York.....See Page 126
Jay & Cook..... " " ..... " 234
Leffingwell & Co.....Cleveland, Ohio..... " 190

Glass—Window.

D. R. Hobart & Co.....New York.....See Page 126
Jay & Cook..... " " ..... " 234
Leffingwell & Co.....Cleveland, Ohio..... " 190

Glaziers' Points.

D. R. Hobart & Co.....New York.....See Page 126
G. B. Walbridge..... " " ..... " 130
Leffingwell & Co.....Cleveland, Ohio..... " 190
Jay & Cook.....New York..... " 234

Globe and Angle Valves.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116

Gongs.

J. J. Walworth.....Chicago, Ill.....See Page 124
Radley & McAlister Manufacturing Co.....New York..... " 250

Grindstones.

W. R. Wood & Co.....New York.....See Page 210

BAND IRON.

Number of Feet in a Bundle of 112 *Pounds.*

Size, Width.	Thick.	Feet in Bundle.	Size, Width.	Thick.	Feet in Bundle.
1⅛ Inches	No. 12	265	2¾ Inches	No. 12	110
1⅛ "	" 10	213	2¾ "	" 10	88
1⅛ "	" 7	160	2¾ "	" 8	72
1¼ "	" 12	246	2¾ "	" 6	60
1¼ "	" 10	190	3 "	" 12	101
1¼ "	" 7	145	3 "	" 10	80
1½ "	" 12	205	3 "	" 8	66
1½ "	" 10	160	3 "	" 6	57
1½ "	" 7	120	3¼ "	" 10	75
1¾ "	" 12	175	3¼ "	" 8	60
1¾ "	" 10	138	3¼ "	" 6	50
1¾ "	" 8	110	3½ "	" 10	69
1¾ "	" 7	100	3½ "	" 8	57
2 "	" 12	155	3½ "	" 6	48
2 "	" 10	120	4 "	" 10	60
2 "	" 8	99	4 "	" 8	50
2 "	" 7	90	4 "	" 6	40
2 "	" 6	81	4½ "	" 10	52
2¼ "	" 12	135	4½ "	" 8	43
2¼ "	" 10	105	4½ "	" 6	35
2¼ "	" 8	88	5 "	" 10	48
2¼ "	" 6	72	5 "	" 8	40
2½ "	" 12	120	5 "	" 6	34
2½ "	" 10	95	6 "	" 10	40
2½ "	" 8	77	6 "	" 8	32
2½ "	" 6	65	6 "	" 6	26

Hosted by Google

THE WIARD

Steam Boiler Attachment,

AN ABSOLUTE PREVENTIVE

OF

BOILER EXPLOSIONS,

AND

Fires Resulting from Super-Heated Steam.

APPLICABLE TO ALL KINDS OF BOILERS.

23 DEY STREET, NEW YORK.

THE ADVANTAGES OF THIS MACHINE ARE:

First.

It is **AUTOMATIC,** without moving parts, certain of operation, without attention; has not the slightest liability to get out of repair; in fact, no more so than a steam pipe.

Second.

IT ABSOLUTELY PREVENTS EXPLOSIONS, RUPTURES, AND LEAKS OF BOILERS, HOWEVER LOW THE WATER MAY BE, AND RETARDS LOCAL OXIDIZING.

Third.

It absolutely prevents all **FIRES** which result from **SUPERHEATED STEAM,** now well known to be the prolific **CAUSE OF CONFLAGRATIONS.**

Fourth.

IT SAVES FROM TEN TO TWENTY PER CENT OF ALL THE FUEL used in generating steam, by steadily causing dry steam—neither superheated nor surcharged with water—to be furnished to the engine. Thus less feed water is required, and obviously less fuel.

Fifth.

By its operation the loose sediment is **FREQUENTLY DISCHARGED,** by which the boiler is cleaned, and kept clean, without the necessity of blowing out the hot water and filling up again with cold water.

Hosted by Google

Sixth.

IT WILL SAVE OVER ONE-HALF OF ALL THE REPAIRS TO BOILERS, by keeping all parts of the iron, the water, and the steam at a practically equal temperature. Thus the strains of unequal expansion and contraction are avoided.

Seventh.

It will more than **DOUBLE** the time a boiler will last in a perfectly serviceable condition.

Eighth.

IT WILL SAVE A LARGE PROPORTION OF THE REPAIRS TO THE ENGINE. By insuring dry steam, not surcharged with water, no loose sediment or grit is carried over to cut the valves, piston or cylinder, and no solid water is presented between the piston and cylinder heads to cause pounding, to break or derange the head or flanges of the cylinder or other parts of the engine.

Ninth.

It may save a large proportion of the oil used for lubricating the cylinder and valves of the engine. In fact, all devices for supplying oil to cylinders of high pressure engines may be safely abolished, as the Boiler Attachment will insure the supply of the best quality of steam for lubrication; and steam, neither superheated nor surcharged with water, is the best kind of a lubricator, and is always present at the time and place it is required.

While the

WIARD STEAM BOILER ATTACHMENT

was founded upon the idea or theory that *EXPLOSIONS, RUPTURES, AND LEAKS OF STEAM BOILERS* were caused by unequally heating or cooling the different parts of the boiler, it will absolutely prevent such accidents or injury to the boilers on which it may be applied, even upon the supposition that any other theory ever advanced or advocated is or may be the correct one.

No person, since it was invented, has been ingenious enough to invent or suggest any possible way to injure a boiler on which it has been applied.

While we will undertake to explode or destroy any boiler whatever, even with the safety valves in good order, and without over-pressure on which the attachment is not applied, and with only the ordinary fires, we defy any engineer to injure a boiler in the slightest degree on which it is applied, either by subjecting it to the same conditions or any other, except disarranging the safety valve.

For further information, apply to

The Wiard Locomotive Attachment Co.,

23 DEY ST., NEW YORK.

Hosted by Google

BRUCE & COOK,

IMPORTERS of METALS

186, 188 & 190 Water Street, and 248 & 250 Pearl Street,

NEW YORK.

TIN PLATE, SHEET IRON, COPPER, ANTIMONY, LEAD, SHEET ZINC, BLOCK TIN, GALVANIZED SHEET IRON, TINNED and BRIGHT WIRE, ANNEALED FENCE WIRE, TINSMITHS' TOOLS and MACHINES, BAR and SHEET LEAD and LEAD PIPE.

JOHN M. BRUCE, JR. JOHN C. COOK. RUSSELL W. McKEE.

PHILIP S. MILLER. *LENOX SMITH.*

AMERICAN and FOREIGN

STEEL AND IRON RAILS

Street Rails, Railway Fastenings, &c.

Locomotives, Cars and Machinery.

The Dickson Manufacturing Company of Scranton.

MILLER & SMITH,

43 EXCHANGE PLACE, - NEW YORK.

DEGRAUW, AYMAR & CO.

IMPORTERS and DEALERS IN

CHAINS, ANCHORS, BUNTING,

RUSSIA BOLT ROPE and WIRE ROPE.

MANUFACTURERS OF

CORDAGE AND OAKUM.

42 SOUTH STREET, NEW YORK.

The Highest Grades of Crane Chains a Specialty.

REFINED TALLOW FOR CYLINDERS.

Hosted by Google

Grindstone Boxes.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Gun Powder.

Laflin & Rand Powder Co.....New York. See Page next to Back Cover.

Gutta Percha.

Bishop Gutta Percha Works.....New York.....See Page 34
Geo. W. Mowbray .....North Adams, Mass..... .. " 82
Geo H. Bliss & Co..... .....Chicago, Ill..... " 146
Bishop Gutta Percha Works..... .....New York.....See Page 43

Gutta Percha Pipe—For Water, Beer, Soda, or Acid.

Bishop Gutta Percha Works.....New York.....See Page 34

Hammer Dies.

The Atlas Works.....Pittsburgh, Pa.....See Page 172

Hammers.

England & Bindley.....Pittsburgh, Pa.....See Page 162
Hermann Boker & Co.....New York.....See Pages 152, 154
Nelson Tool Works..... " " .....See Page 30
Pratt & Co.....Buffalo, N. Y..... " 132
Tyng & Co.....New York..... ..... " 260
Wm. Green & Co.....Wilmington, Del..... " 248

HEMPEN ROPES AND CABLES—SAFE LOADS.

(*From Haslett.*)

ROPES.

To find the Strain that may be applied to a Hempen Rope with Safety.

Circumference.	Pounds.	Circumference.	Pounds.	Circumference.	Pounds.
1	200	3¼	2450	6	7200
¼	312	½	28'2	¼	7812
½	450	¾	32 0	½	8450
¾	612	4	3612	¾	9112
2	800	¼	4050	7	9800
¼	1012	½	4512	¼	10512
½	1250	¾	5000	½	112 0
¾	1512	5	5512	¾	12012
3	1800	¼	6050	8	12800
¼	2112	½	6612		
		¾			

CABLES.

To find the Strain that may safely be applied to a good Hempen Cable.

Circumference.	Pounds.	Circumference.	Pounds.	Circumference.	Pounds.
6	4320	10¼	12607	14½	25230
¼	4687	½	13230	¾	26107
½	5070	¾	13867	15	27000
¾	5467	11	14520	¼	27907
7	5880	¼	15187	½	28830
¼	6307	½	15870	¾	29767
½	6750	¾	16567	16	30720
¾	7207	12	17280	¼	31687
8	7680	¼	18007	½	32670
¼	8167	½	18750	¾	33667
½	8670	¾	19507	17	34680
¾	9187	13	20280	¼	35707
9	9720	¼	21067	½	36750
¼	10267	½	21870	¾	37807
½	10830	¾	22687	18	38880
¾	11407	14	23520	¼	39967
10	12000	¼	24367		

To Ascertain the Strength of Cables.—Multiply the square of the circumference in inches by 120, and the product is the weight the cable will bear in pounds, with safety.

To Ascertain the Strength of Ropes.—Multiply the square of the circumference in inches by 20 ', and it gives the weigth the rope will bear in pounds, with safety.

To Ascertain the Weight of Manilla Ropes and Hawsers.—Multiply the square of the circumference in inches by .03, and the product is the weight in pounds of a foot in length.

This is but an approximation, sufficiently correct for many purposes.

Hosted by Google

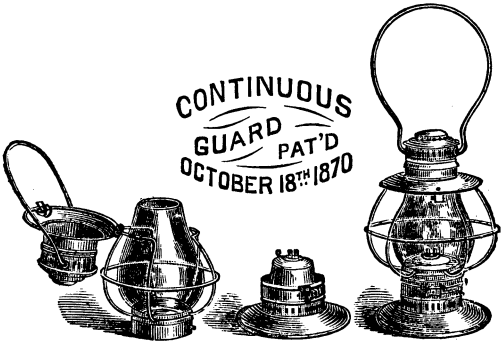
NEW YORK LANTERN COMPANY,

MANUFACTURERS OF

Railroad, Ship,

AND

Hand Lanterns,



Woodward's, French's Screw, Excelsior Reflector,

Sweeny's and Avery's Railroad Lanterns

AND

AMBROSE'S PATENT NO CHIMNEY

STREET AND CAR LAMPS.

—— ALSO, ——

Street Lamps for Light Oil with Patent Burners.

S. M. AIKMAN & CO.,

261 PEARL ST., NEW YORK.

Hosted by Google

Hand Forcing Machines.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Hand Lamps.

S. M. Aikman & Co.....New York.....See Page 114

Hand Lathes.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Hand Punches.

Biddle Manufacturing Co.....New York.....See Page 12

Hand Shears.

Biddle Manufacturing Co.....New York.....See Page 12

Hand Stamps.

Mathiesen & Schrader.....New York.....See Page 82

Hangers, &c.

Buffalo Machinery Agency.....Buffalo, N. Y.....See Page 160
Geo. V. Cresson.....Philadelphia, Pa..... " 138
J. S. Mundy.....Newark, N. J..... " 226
R. L. Howard & Son.....Buffalo, N. Y..... " 40
Wm. Sellers & Co.....Philadelphia, Pa..... " 64
See also, Shafting.

Hardware.

Biddle Manufacturing Co.....New York.....See Page 12
D. Brewer & Co.....Philadelphia, Pa..... " 246
England & Bindley.....Pittsburgh, Pa..... " 162
G. B. Walbridge.....New York..... " 130
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
H. B. Newhall, Agent.....New York..... " 166
Hermann Boker & Co..... " " .....See Pages 152, 154
Sidney Shepard & Co.....Buffalo, N. Y.....See Page 196

Hard Wood Doors.

Joseph Churchyard.....Buffalo, N. Y.....See Page 160

Harness.

C. M. Moseman & Bro.....New York.....See Page 226

EFFECT OF HEAT UPON VARIOUS BODIES.

(Condensed from Haswell.)

Wedgewood's zero is 1077° of Fahrenheit, and each degree = 130°.

In the designation of the degrees of temperature, the symbol + is omitted when the temperature is above 0; but when it is below, the symbol − is prefixed.

	Degrees.
Ammonia Boils	140
Ammonia (liquid) freezes	−46
Antimony melts	951
Arsenic melts	365
Bismuth melts	476
Blood (human) heat of	98
" " freezes	25
Brandy freezes	−7
Brass melts	1900
Cadmium melts	600
Coal Tar boils	325
Cold, greatest artificial	−166
" greatest natural	−56
Common Fire	790
Copper melts	2548
Glass melts	2377
Gold (fine) melts	2590
Gutta-percha softens	145
Heat, cherry red	1500
" " (Daniell)	1141
" bright red	1860
" red visible by day	1077
" white	2900
Ice melts	32
Iron (cast) melts	3479
" (wrought) melts	3980

	Degrees.
Iron, bright red in the dark	752
" red hot in twilight	884
Lead melts	504
Mercury boils	662
" volatilizes	680
" melts	−39
Naptha boils	186
Petroleum boils	306
Platinum melts	3080
Potassium melts	135
Proof Spirit freezes	−7
Saltpetre melts	600
Sea-water freezes	28
Silver (fine) melts	1250
Snow and Salt, equal parts	0
Spirits of Turpentine freezes	14
Steel melts	2500
" polished, blue	580
" " straw color	460
Strong Wines freeze	20
Sulphur melts	226
Sulph. Acid (sp. grav. 1.641) freezes	−45
Tin melts	421
Vinous fermentation	60 to 77
Water, in *vacuo* boils	98
Zinc melts	740

Hosted by Google

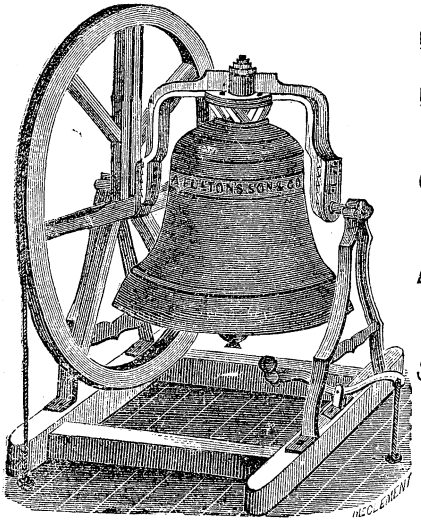
Fulton's Bell and Brass Foundry,

91 First Avenue & 70 Second Avenue,

PITTSBURGH, PA.

A. FULTON'S SON & CO.

MANUFACTURERS OF



BELLS

FOR

CHURCHES,
SCHOOLS,
LOCOMOTIVES,
FACTORIES,
STEAMBOATS,
ENGINES,

AND

ALL OTHER PURPOSES.

ALSO,

Car Bearings, Brass Castings,
Babbitt Metal, Steam Gauges,
Globe and Angle Valves,

AND DEALERS IN

Railroad Supplies.

☞ SEND FOR CATALOGUE. ☜

Hosted by Google

Harrow Teeth.

Hermann Boker & Co.....New York.....See Pages 152, 154

Hasps.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Hassocks—Carpet.

New York Ottoman & Hassock Co.....New York.....See Page 236
Geo. Drake Smith.....Philadelphia, Pa..... " 246

Head Lamps and Lights.

L. G. Tillo'son & Co.....New York.....See Page 94
Radley & McAlister Manufacturing Co..... " " ..... " 250
Vose, Dinsmore & Co..... " " ..... " 60
Wm. B. Browne & Co..... " " ..... " 266

Head Light Oil.

F. S. Pease.....Buffalo, N. Y.....See Page 100
Wm. B. Browne & Co.....New York..... " 266

BAR AND SHEET COPPER.

Weight in Pounds.

Thickness, or Diameter, or Side; Inches.	Sheets per Square Foot.	Square Bars 1 Foot Long.	Round Bars 1 Foot Long.	Thickness, or Diameter, or Side; Inches.	Sheets per Square Foot.	Square Bars 1 Foot Long.	Round Bars 1 Foot Long.
1/16	2.88	.015	.011	11/16	49.	4.35	3.41
1/8	5.75	.06	.046	1/8	52.	4.86	3.85
3/16	8.65	.134	.105	3/16	54.9	5.40	4.29
1/4	11.48	.235	.187	1/4	57.65	6.	4.73
5/16	14.36	.375	.295	5/16	60.5	6.6	5.20
3/8	17.28	.54	.424	3/8	63.45	7.27	5.70
7/16	20.19	.735	.575	7/16	66.35	7.90	6.28
1/2	23.1	.960	.75	1/2	69.3	8.64	6.80
9/16	26.	1.21	.95	9/16	72.15	9.28	7.30
5/8	28.85	1.51	1.17	5/8	75.1	10 15	8.
11/16	31.68	1.81	1.42	11/16	77.95	10.95	8.6
3/4	34.57	2.15	1.7	3/4	80.75	11.70	9.24
13/16	37.46	2.54	2.	13/16	83.60	12.60	9.85
7/8	40.39	2.95	2.3	7/8	86.58	13.46	10.55
15/16	43.27	3.37	2.64	15/16	89.45	14.35	11.25
1	46.15	3.84	3.01	2	92.25	15.35	12.

BAR AND SHEET LEAD.

Weight in Pounds.

Thickness, or Diameter, or Side; Inches.	Sheets per Square Foot.	Square Bars 1 Foot Long.	Round Bars 1 Foot Long.	Thickness, or Diameter, or Side; Inches.	Sheets per Square Foot.	Square Bars 1 Foot Long.	Round Bars 1 Foot Long.
1/16	3.71	.02	.014	11/16	63.2	5.6	4.4
1/8	7.43	.079	.06	1/8	66.87	6.26	4.91
3/16	11.	.175	.136	3/16	70 51	6.98	5.5
1/4	14.08	.31	.245	1/4	74.35	7.74	6.1
5/16	18.05	.486	.38	5/16	78.05	8.55	6.73
3/8	22.02	.695	.549	3/8	81.76	9.38	7.38
7/16	26.	.948	.745	7/16	85.48	10.18	8.05
1/2	29.75	1.25	.975	1/2	89.28	11.0	8.75
9/16	33.49	1.55	1 24	9/16	93.	12.05	9.50
5/8	37.18	1.95	1.51	5/8	96.78	13.15	10.25
11/16	40.87	2.33	1.85	11/16	100.5	14.15	11.06
3/4	44.58	2.8	2.2	3/4	104.1	15.18	11.88
13/16	48.28	3.28	2.58	13/16	107.8	16.30	12.76
7/8	52.12	3.8	2.98	7/8	112.3	17.45	13.66
15/16	56 05	4.35	3.41	15/16	116.	18.10	14.61
1	59.48	4.95	3.9	2	119,6	19.78	15.58

Hosted by Google

E. KAYLOR, President. *R. H. LEWIS, Treasurer.*
H. F. LYNCH, Secretary.

PITTSBURGH BOLT CO.

MANUFACTURERS OF

Merchant Bar Iron,

FISH BARS and BOLTS,

Patent Hot Hammered Bolts and Nuts.

WASHERS, WOOD SCREWS,

R. R. FROGS AND SWITCHES,

CAR AND BRIDGE BOLTS,

RIVETS AND PATCH BOLTS,

Office, 369 Liberty St.,

Post Office Lock Box 446. **PITTSBURGH. PA,**

Hosted by Google

Head Linings.

Vose, Dinsmore & Co.....New York.....See Page 60

Heating Apparatus

A. Carr.....New York.....See Page 244

Hinge Nails.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Hinges.

Lewis Oliver & Phillips; H. B. Newhall, Ag't...New York.....See Page 166
Pratt & Co.....Buffalo, N. Y..... " 132
Providence Tool Co; H. B. Newhall, Agent.....New York..... " 166
Wm. Green & Co.....Wilmington, Del..... " 248

Hoes.

Hermann Boker & Co.....New York.....See Pages 152, 154

Hoisting Crappie.

Hermann Boker & Co.....New York.....See Pages 152, 154

Hoisting Machines.

J. S. Mundy.....Newark, N. J.....See Page 266
R. L. Howard & Son.....Buffalo, N. Y..... " 40
Skinner & Gifford Manufacturing Co.....Dunkirk. N. Y..... " 140
Speedwell Iron Works.....New York..... " 122
Wm. Sellers & Co.....Philadelphia, Pa..... " 64

Hoop Iron.

Atwater, Wheeler & Co.....New Haven, Conn.....See Page 10
Jones & Laughlins.....Pittsburgh, Pa..... " 32
Marshall Lefferts,Jr—(Galvanized Iron).....New York..... " 44

Hoppers.

L G. Tillotson & Co.....New York.....See Page 94

Horse Shoe Iron.

Pittsburgh Bolt Co.....Pittsburgh, Pa.....See Page 118

IRON, SPLICES AND BOLTS REQUIRED FOR ONE MILE OF TRACK.

Tons of Iron.

Rule.—To find the No. of Tons of Rail to the mile, divide the weight per yard by 7, and multiply by 11, thus: for 56 lb. rail, divide 56 by 7, equal 8, multiplied by 11, equal 88 tons, for one mile of single track,

Weight of Rail, per Yard	Tons per Mile.	Weight of Rail, per Yard.	Tons per Mile.
12 pounds.	12 Tons 920 Pounds.	45 pounds.	70 Tons 1600 Pounds.
14 "	22 "	48 "	75 " 960 "
16 "	25 " 320 "	50 "	78 " 1280 "
18 "	28 " 640 "	52 "	81 " 1600 "
20 "	31 " 960 "	56 "	88 "
22 "	34 " 1280 "	57 "	89 " 1280 "
25 "	39 " 6 0 "	60 "	94 " 640 "
26 "	40 " 1920 "	62 "	97 " 960 "
27 "	42 " 960 "	64 "	100 " 1280 "
28 "	44 "	65 "	102 " 320 "
30 "	47 " 320 "	68 "	106 " 1920 "
33 "	51 " 1920 "	70 "	110 "
35 "	55 "	72 "	113 " 320 "
40 "	62 " 1920 "	76 "	119 " 960 "

Splices and Bolts for One Mile of Track.

30	Feet of Rail,	requires	704	Splices;	1,408	Bolts and	Nuts.
28	"	"	754	"	1 508	"	"
27	"	"	782	"	1,564	"	"
25	"	"	844	"	1,688	"	"
24	"	"	880	"	1,760	"	"

Hosted by Google

CLEVELAND MACHINERY DEPOT,

Salesroom, 89 Bank St. Warehouse, 57 Centre St.,

CLEVELAND, OHIO.

Phelps & Sanger,

MANUFACTURERS' AGENTS

BLAKE'S Steam Pumps.
BAXTER Steam Engines.
STURTEVANT'S Blowers.
TOMPKINS' Wood-Working Machinery.
SMITH & GARVIN'S Drills and Milling Machines.
NATIONAL TUBE WORKS
OF
BOSTON, MASS., and McKEESPORT, PA.

ALSO, A GENERAL STOCK OF

IRON WORKING MACHINERY,
SCALES, STEAM GAUGES,

&c., &c., &c., &c.

ALWAYS ON HAND A LARGE AND COMPLETE STOCK OF

Lapweld Pipe, Boiler Tubes,

AND A GENERAL AND COMPLETE ASSORTMENT OF

Steam, Gas and Plumbers'
Brass and Iron Goods and Tools,

AND

RAILWAY SUPPLIES.

SEND FOR CIRCULARS AND PRICE LISTS.

Hosted by Google

Horse Shoes.

Wm. Green & Co .....Wilmington, Del.....See Page 248
Reese, Graff & Woods .....Pittsburgh, Pa..... " 68

Horse Shoers' Tools.

Nelson Tool Works.....New York.....See Page 30

Hose.

A. Carr.....New York .....See Page 244
Bickford, Curtiss & Deming.....Buffalo, N. Y..... " 136
Crane Bros Manufacturing Co.....Chicago, Ill..... " 230
Darrow, Turner & Co.....New York..... " 62
Goodyears I. R. G. Manufacturing Co..... " " ..... " 252
J. D. West & Co..... " " ..... " 56
New York Rubber Co..... " " ..... " 260
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138
Vose, Dinsmore & Co.....New York..... " 60

Hose and Ladder Straps.

Darrow, Turner & Co.....New York.....See Page 62

Hose Couplings.

A. Carr.....New York.....See Page 244
Biddle Manufacturing Co..... " " ..... " 12
Crane Bros. Manufacturing Co.....Chicago, Ill..... " 230
J. J. Walworth..... " " ..... " 124
Vose, Dinsmore & Co.....New York..... " 60
Darrow, Turner & Co..... " " ..... " 62

Hose Jacket.

Darrow, Turner &Co.....New York.....See Page 62

Hose Pipes.

Darrow, Turner & Co.....New York .....See Page 62

Hotel Annunciators.

Charles T. Chester.....New York..... Page 212
Geo. H. Bliss & Co.....Chicago, Ill..... " 164
M. A. Buell.....Cleveland, Ohio..... " 46

NUMBER OF RAILS, CHAIRS, OR JOINTS, PER MILE OF SINGLE TRACK.

Length of Rail.	No.	Length of Rail.	No.
18 Feet.	587	24 Feet.	440
20 "	528	26 "	406
21 "	503	28 "	377
22 "	480	30 "	352

NUMBER OF CROSS-TIES PER MILE OF SINGLE TRACK.

Distance from centre to centre,	2 feet	2641 ties.
" " "	2¼ "	2348 "
" " "	2½ "	2113 "
" " "	2¾ "	1921 "
" " "	3 "	1761 "

SPIKES TO THE MILES, SINGLE TRACK.

Sizes, 5½ by ½	5000 lbs. equals 33 1-3 kegs of 150 lbs. each.
" 5½ by 9/16	4230 lbs. " 28 1-5 " 150 "
" 5½ by ½	about 342 to a keg of 150 lbs.
" 5½ by 9/16	" 284 " " 150 lbs.

IMPROVED TRACING PAPER.

Puscher of Nuremburg has lately suggested a solution of castor oil in absolute alcohol for the purpose of manufacturing a tracing paper. The oil is to be diluted with one, two, or three times its bulk of alcohol, according to the thickness of the paper and the amount consequently required for rendering it transparent. This can be laid on by means of a sponge; and in a very few minutes after the application the paper will be dry, transparent, and ready for use. It will readily receive the mark of a pencil or India ink, and as by immersion in absolute alcohol the oil can be removed, the paper can be restored to its original condition, if desired.

Hosted by Google

ANSONIA BRASS AND COPPER CO.

MANUFACTURERS OF

Braziers', Bolt and Sheathing Copper.
Brass and Copper Wire and Tubing.
Sheet Brass. Brass Kettles.
Copper Rivets and Burs.
Copper Bottoms.
Lamp Burners and Brass Lamps.
Iron Wire, CLOCKS, &c.

WAREROOMS:

19 & 21 CLIFF STREET, NEW YORK.

Factory, ANSONIA, Connecticut.

OXFORD IRON CO.

Nos. 81, 83 & 85 Washington St.,

Near Rector Street, NEW YORK.

RAILROAD SPIKES, SPLICE BARS,

TRACK BOLTS and NUTS, CUT NAILS and SPIKES,

PIG IRON, &c., &c.

COLLIER & SCRANTON, Agents.

BACON'S
HOISTING ENGINES

For Contractors, Mines, Blast Furnaces, &c.

Adapted to every possible duty. In use by all of the principal Contractors.

ALSO

BOILERS, CENTRIFUGAL PUMPS,

AND ALL KINDS OF

CONTRACTORS' MACHINERY.

SPEEDWELL IRON WORKS,

36 CORTLAND ST., NEW YORK.

Hosted by Google

Hydrants.

A. Carr.....New York.....See Page 244
R. A. Brick & Co..... " " ..... " 48

Hydraulic Engines.

Winans & Co.....New York.....See Page 106

Hydraulic Jacks.

L. G. Tillotson & Co.....New York.....See Page 94
R. Dudgeon..... " " ..... " 70
Vose, Dinsmore & Co..... " " ..... " 60

Hydraulic Machinery.

Bolen, Crane & Co.....Newark, N. J.....See Page 62
Winans & Co.....New York..... " 106

Hydraulic Pipe.

Winans & Co.....New York.....See Page 106

Hydraulic Presses.

Winans & Co.....New York.....See Page 106

Hydraulic Punches.

R. Dudgeon.....New York.....See Page 70
Winans & Co..... " " ..... " 106

Hydraulic Valves.

Winans & Co.....New York.....See Page 106

Hydrostatic Wheel Presses.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Incrustation Powders.

H. N. Winans.....New York..... See Page 108
Wiard Locomotive Attachment Co (Anti-Incrustation)..... " " .....See Page 110

SHEETS OF SHEET-COPPER.

Standard Sizes.

(Ansonia Brass & Copper Co.)

Thickness. B.W.G.	Sizes of Sheets, and Weight of each Sheet in Pounds. 14 by 48	24 by 48	30 by 60	36 by 72	48 by 72
1	—	116	181	261	348
2	—	111	174	250	334
3	—	102	159	230	306
4	—	93	145	209	278
5	—	81	126	182	242
6	—	75	118	169	226
7	—	70	109	157	209
8	—	63	99	142	190
9	—	58	90	130	173
10	—	48	81	117	156
11	—	46	73	104	139
12	—	41	64	91	122
13	—	35	54	78	104
14	—	29	45	65	86
15	—	26	41	59	78
16	—	23	36	52	70
17	—	20	32	45	60
18	—	18	27	39	52
19	—	16	24	35	47
20	—	14	22	32	43
21	—	13	20	29	39
22	6½	12	18	26	35
23	5⅞	10	16	23	31
24	5¼	9	15	21	28
25	4⅝	8	12½	19	25
26	4	7	11	15	21
27	3½	6	9⅜	13	18
28	3	5	7	11	15

Hosted by Google

GEO. H. CRAIN & COMPANY,

Railroad Iron and Securities,

ENGINES, CARS, &c.

Railway, Contractors' and Machinists' Supplies,

Telegraph Instruments and Material.

145 So. Clark St., Chicago.

E. W. BLATCHFORD & CO.

MANUFACTURERS OF

Lead Pipe, Sheet Lead,

PIG LEAD,

LINSEED OIL,

RAW AND BOILED.

70 NORTH CLINTON STREET, CHICAGO, ILL.

JAMES J. WALWORTH,

MANUFACTURER AND DEALER IN

WROUGHT IRON WELDED TUBES,

FOR GAS, STEAM AND WATER.

Steam Pumps, Steam Gauges, Scotch Water Gauge Glasses,
Brass Valves, Cocks, Whistles, and other Brass Goods.

STEAM AND GAS FITTERS' TOOLS AND SUPPLIES.

Leather and Rubber Belting and Hose,
Rubber, Hemp and Flax Packing, Hair Felting,

BRANFORD MALLEABLE IRON FITTINGS.

243 & 245 LAKE STREET. - - CHICAGO.

Hosted by Google

Iron.

Chas. W. Matthews	Philadelphia, Pa.	See Page 38
Jones & Laughlins	Pittsburgh, Pa.	" 32
Leng & Ogden	New York... See Page next to Back Cover	
Lewis Oliver & Phillips; H. B. Newhall, Ag't	New York	See Page 166
O. W. Child	" "	" 262
P. H. Moffat	Chicago, Ill.	" 190
Reese, Graff & Woods	Pittsburgh, Pa.	" 68
Tyng & Co.	New York	" 260

Iron—Bar.

Atwater, Wheeler & Co.	New Haven, Conn.	See Page 10
Jones & Laughlins	Pittsburgh, Pa.	" 32
Marshall Lefferts, Jr. (Galvanized Iron)	New York	" 44
P. H. Moffat	Chicago, Ill.	" 190
Pittsburg Bolt Co.	Pittsburgh, Pa.	" 118
Tyng & Co.	New York	" 260
Vose, Dinsmore & Co.	" "	" 60
Wm. Green & Co.	Wilmington, Del.	" 248

Iron Buildings.

Noyes & Wines	New York	See Page 264

LIST OF CALIBRE AND WEIGHTS OF LEAD PIPES.

Furnished by E. W. Blatchford & Co.

Calibre.	Weight per foot. Lbs.
¼ inch tubing	⅜
⅜ inch aqueduct	½
light	¾
medium	1
strong	1½
extra strong	2
½ inch aqueduct	⅝
extra light	¾
light	1
medium	1¼
strong	1¾
extra strong	2...
⅝ inch aqueduct	¾
extra light	1¼
light	1¾
medium	2
strong	2½
extra strong	3
¾ inch aqueduct	1
extra light	1½
light	2
medium	2¼
strong	3
extra strong	3½
⅞ inch aqueduct	1½
extra light	2
light	2¼
1 inch aqueduct	1½
extra light	2
light	2½
medium	3¼
strong	4
extra strong	4¾
1¼ inch aqueduct	2
extra light	2½
light	3
medium	3¾
strong	4¾
extra strong	6
1½ inch aqueduct	3
extra light	3½
light	4
medium	5
strong	6
extra strong	7½
1¾ inch extra light	3¼
light	4½
medium	5½
strong	6½
extra strong	8
2 inch waste	3
extra light	4
light	5
medium	7
strong	8
extra strong	9
2½ inch 3/16 thick	8
¼ thick	11
5/16 thick	14
⅜ thick	17
3 inch waste	5
3/16 thick	9
¼ thick	12
5/16 thick	16
⅜ thick	20
3½ inch ¼ thick	15
5/16 thick	18
⅜ thick	21
4 inch waste	5
¼ thick	16
5/16 thick	21
⅜ thick	25
7/16 thick	30
4½ inch waste	6
5 inch waste	8

Aqueduct Pipe is put up on reels. Other sizes in coils of about 170 lbs. each. Waste Pipe, and all pipe over 2 inches in diameter, is made in lengths of 10 to 15 feet.

Hosted by Google

D. R. HOBART & CO.

No. 8 Murray Street,

Near Broadway, **NEW YORK.**

IMPORTERS OF

CAR, PLATE,

FRENCH WINDOW,

COACH AND PICTURE

GLASS.

EVERY DESCRIPTION OF

ENAMELED,

COLORED,

EMBOSSED,

AND

CUT GLASS,

FOR

DOORS AND ELEVATED DECKS.

Glaziers' Diamonds, Points, Putty, &c.

D. R. HOBART. KONRAD SCHNEIDER.

Hosted by Google

Iron Burs.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Iron Doors and Shutters.

Noyes & Wines.....New York.....See Page 264

Iron Fittings.

A. Carr.....New York.....See Page 244
Hart, Ball & Hart.....Buffalo, N. Y.....“ 136
J. J. Walworth.....Chicago, Ill.....“ 124
McNab & Harlin Manufacturing Co.....New York.....“ 220
Pancoast & Maule.....Philadelphia, Pa.....“ 26
See also Gas and Steam Fittings.

Iron Founders.

Bowlers, Maher & Brayton.....Cleveland, Ohio.....See Page 42
Davenport, Fairbairn & Co.....“ “ .....“ 188
Jonas S. Heartt & Co.....Troy, N. Y.....“ 134
Ramapo Wheel & Foundry Co.....Ramapo, N. Y.....“ 256
The Pratt & Whitney Co.....Hartford, Conn.....“ 142
Wason Manufacturing Co.....Springfield, Mass.....“ 146
Wm. P. Kellogg & Co.....Troy, N. Y.....“ 98

Iron Merchants.

Jno. W. Quincy.....New York.....See Page 178
Leng & Ogden.....New York...See Page next to Back Cover
Tyng & Co.....“ “ .....See Page 260

Iron Ore Crushers.

Phelps & Sanger.....Cleveland, Ohio.....See Page 120

GLASS.

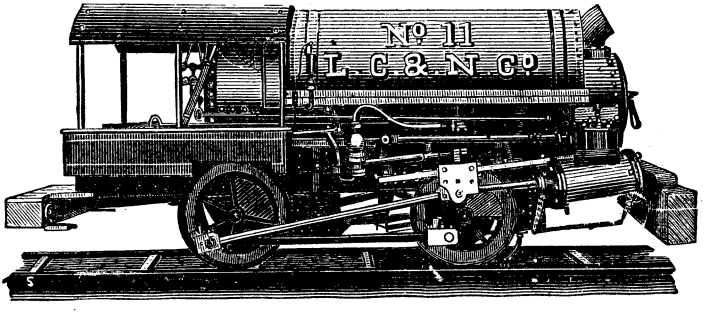
Number of Panes per 50 Feet, or in 1 Box.

Size.	Panes.	Size.	Panes.	Size.	Panes.	Size.	Panes.
6 by 8	150	12 by 14	43	14 by 24	22	20 by 24	15
7 “ 9	114	12 “ 15	41	15 “ 15	32	20 “ 25	14
8 “ 10	90	12 “ 16	38	15 “ 16	30	20 “ 26	14
8 “ 11	82	12 “ 17	35	15 “ 18	27	20 “ 28	13
8 “ 12	75	12 “ 18	33	15 “ 20	24	21 “ 27	13
9 “ 10	80	12 “ 19	32	15 “ 21	23	22 “ 24	14
9 “ 11	73	12 “ 20	32	15 “ 22	22	22 “ 26	13
9 “ 12	67	12 “ 21	29	15 “ 24	20	22 “ 28	12
9 “ 13	61	12 “ 22	28	16 “ 16	28	24 “ 28	11
9 “ 14	57	12 “ 23	26	16 “ 17	26	24 “ 30	10
9 “ 15	53	12 “ 24	25	16 “ 18	25	24 “ 32	9
9 “ 16	50	13 “ 14	39	16 “ 20	23	25 “ 30	10
10 “ 10	72	13 “ 15	37	16 “ 21	21	26 “ 36	8
10 “ 12	60	13 “ 16	35	16 “ 22	20	28 “ 34	8
10 “ 13	55	13 “ 17	33	16 “ 24	19	30 “ 40	6
10 “ 14	51	13 “ 18	31	17 “ 17	25	31 “ 36	6
10 “ 15	48	13 “ 19	29	17 “ 18	24	31 “ 40	6
10 “ 16	45	13 “ 20	27	17 “ 20	21	31 “ 42	6
10 “ 17	42	13 “ 21	26	17 “ 22	19	32 “ 42	5
10 “ 18	40	13 “ 22	25	17 “ 24	18	32 “ 44	5
11 “ 11	59	13 “ 24	23	18 “ 18	22	33 “ 45	5
11 “ 12	55	14 “ 14	37	18 “ 20	20	34 “ 46	5
11 “ 13	50	14 “ 15	34	18 “ 22	18	30 “ 52	4
11 “ 14	47	14 “ 16	32	18 “ 24	17	32 “ 56	4
11 “ 15	44	14 “ 17	30	19 “ 19	20	36 “ 58	3
11 “ 16	41	14 “ 18	29	19 “ 20	19	38 “ 58	3
11 “ 17	39	14 “ 19	27	19 “ 22	17	40 “ 60	3
11 “ 18	36	14 “ 20	26	19 “ 24	16		
12 “ 12	50	14 “ 21	24	20 “ 20	18		
12 “ 13	46	14 “ 22	23	20 “ 22	16		

Hosted by Google

LIGHT LOCOMOTIVES

AN EXCLUSIVE SPECIALTY.



Outside Connected Mine Locomotive, 66 inches High, and 65 inches Wide on 3 feet Gauge.

NARROW GAUGE PASSENGER, with 4 drivers and two wheel truck.	With 6 wheel tender, 10 x 16 Cylinders.	
	With 4 wheel tender, 8 x 16 Cylinders.	
NARROW GAUGE FREIGHT 6 drivers, with or without truck; saddle or tender-tank.	12 x 16,	10 x 16,
	11 x 16,	$9\frac{1}{4}$ x 14.
SPECIAL ENGINES for R. R. Construction and Shifting, Mills, Furnaces, Quarries, Lumber Roads, with Wooden or Iron Rails, Contractors' Use, &c. (With saddle or tender tank, 4 or 6 drivers.)	12 x 18,	12 x 16,
	10 x 16,	9 x 16,
	$9\frac{1}{2}$ x 14,	$9\frac{1}{4}$ x 14,
	$8\frac{1}{4}$ x 16,	8 x 16,
	8 x 14,	7 x 12,
MINING ENGINES,	Outside connected as above, or inside connected, 9 x 12.	

Photograph and Price of Engine, to do the required work, furnished on application. Inquiry should state length of road, gauge, steepest and average grades, radii of curves and whether on grades, weight and kind of rail, and load to be hauled.

PORTER, BELL & CO.,

PITTSBURGH, PENN'A.

Works, 50th St. & A. V. R. R Office, 5 Monongahela House.

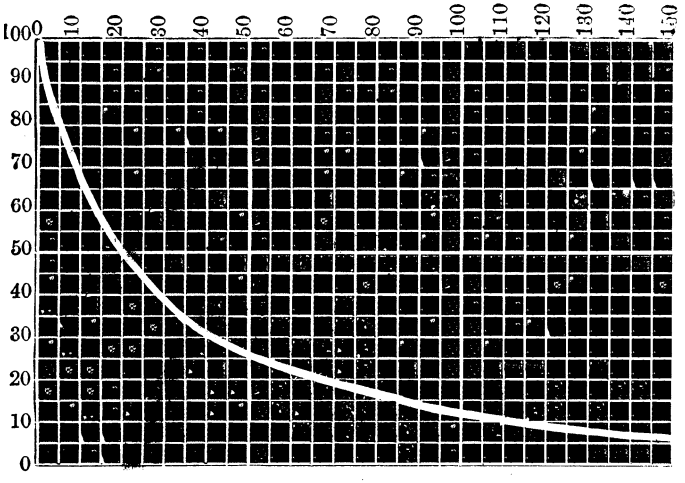
Hosted by Google

DIAGRAM showing proportion between

Maximum Load of Locomotive on Level and on Grades

up to 150 feet per mile. Furnished by *Porter, Bell & Co., Pittsburgh, Pa*

See opposite page.



Example I.—What proportion of its load on level will engine haul on grade of 20 feet per mile?

Look for 20 foot grade at top, follow down perpendicular line to curve, and for percentage look at left hand on horizontal line intersected by the curve.

Answer.—50 per cent.

Example II.—If an engine's maximum load on 20 foot grade is 200 tons, what is its capacity on 40 foot grade?

The diagram gives engine on 20 foot grade 50 per cent. of its capacity on level. Then, 200 tons being 50 per cent., the maximum load on level is 400 tons. The percentage shown on 40 foot grade is 30, and 30 per cent. of 400 gives

Answer, 120 tons.

This Diagram supposes track to be straight and in good order; the load is to be started on grade; the level is supposed to be absolute, though 5 or 10 feet to the mile is as near a level as is often found in practice. Grades of 500 feet per mile can be overcome by engines working by adhesion alone on good T rail. Tenders must be reckoned as a part of the train.

Hosted by Google

GEO. B. WALBRIDGE,

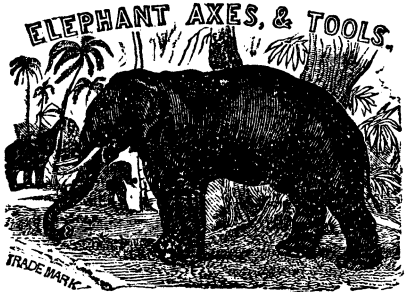
55 Chambers Street, New York.

RAILWAY SUPPLIES,

Nuts, Washers, Spikes,

ADAM'S PATENT NUT LOCKS,

FISH PLATES and BOLTS, CROW BARS, &c.



PICKS and MATTOCKS,

Axe, Pick and Sledge Handles.

DEPOT FOR

SHELTON COMPANY'S

TACKS, BRADS,

Finishing and Clout Nails,

CARRIAGE BOLTS, BED SCREWS, &C.

Hosted by Google

Iron Ores.

Chas. W. Matthews.....Philadelphia, Pa.....See Page 38
Rhodes & Bradley.....Chicago, Ill..... " 192

Iron Padlocks.

Romer & Co.....Newark, N. J.....See Page 204
Ritchie & Son..... " ..... " 44

Iron Paints.

Jno. W. Masury & Son.....New York.....See Page 214

Iron—Pig.

See Pig Iron.

WHITEWASH.

For Outside Wood Work.

Slack ½ bushel of lime, add 2 lbs of white vitrol and water enough to bring to consistence of thick whitewash. This is white and may be colored by adding ochre, umber, lamp black, etc. When lamp black is added to water colors it should first be dissolved in alcohol.

For Stone or Brick Work, etc.

Slack ½ bushel of lime, then fill the barrel two-thirds full of water and add 1 bushel of hydraulic cement, also 3 lbs. of white vitrol dissolved in water. Make about the thickness of paint and lay on with a whitewash brush. It may be improved by adding a peck of white sand before using. This mixture may be colored same as the preceeding one.

For Inside Work.

Whitewash for inside work shonld have no salt in it, for making it permanent use about a quart of thin glue water, or any good clear *size*, to a pailful of wash.

NUMBER OF NAILS AND TACKS PER POUND.

NAILS.

Title.	Size.	No. per lb.
3-penny fine	1⅛ inch.	760 nails.
3 "	1¼ "	480 "
4 "	1½ "	300 "
5 "	1¾ "	200 "
6 "	2 "	160 "
7 "	2¼ "	128 "
8 "	2½ "	92 "
9 "	2¾ "	72 "
10 "	3 "	60 "
12 "	3¼ "	44 "
16 "	3½ "	32 "
20 "	4 "	24 "
30 "	4½ "	18 "
40 "	5 "	14 "
50 "	5½ "	12 "
60 "	6 "	10 "
6 " fence,	2 "	80 "
8 " "	2½ "	50 "
10 " "	3 "	34 "
12 " "	3¼ "	29 "

TACKS.

Title.	Length.	No. per lb.
1 oz.	½ inch.	16,000
1½ "	9/16 "	10,666
2 "	¼ "	8,000
2½ "	3/16 "	6,400
3 "	⅜ "	5,333
4 "	7/16 "	4,000
6 "	9/16 "	2,666
8 "	⅝ "	2,000
10 "	11/16 "	1,600
12 "	¾ "	1,333
14 "	13/16 "	1,143
16 "	⅞ "	1,000
18 "	15/16 "	888
20 "	1 "	800
22 "	1 1/16 "	727
24 "	1⅛ "	666

PASTE, THAT WILL ADHERE TO ANY SUBSTANCE.

Sugar of lead, 720 grs., and alum, 720 grs.; both are dissolved in water. Take 2½ ounces of gum arabic and dissolve in 2 quarts of warm water. Mix in a dish 1 pound of wheat flour with the gum water cold till in pasty consistence. Put the dish on the fire, pour into it the mixture of alum and sugar of lead. Shake well, and take it off the fire when it shows signs of ebulition. Let the whole cool, and the paste is made. If the paste is too thick, add to it some gum water, till in proper consistence.

Hosted by Google

PRATT & CO.,

IMPORTERS and WHOLESALE DEALERS IN

HARDWARE.

PROPRIETORS OF THE

BUFFALO IRON AND NAIL WORKS,
FLETCHER BLAST FURNACES,
SPIKE, BOLT, MACHINE AND FORGE SHOPS.

MANUFACTURERS OF

Pig and Merchant Bar Iron,
Rail, Bridge AND Boat Spikes,
Cold Cut Nuts AND Washers,
Cut and Wrought Nails,

MANUFACTURERS AND DEALERS IN ALL KINDS OF

Railroad AND Contractors' Supplies.

AGENTS FOR

RUSSELL & ERWIN MANF'G CO., Locks of all Kinds.
AMERICAN BUTT CO., Butts of all Kinds.
ROY & CO., Butts and Strap Hinges.
AMERICAN SCREW CO., Wood Screws.
WHEELER, MADDEN & CLEMSON, Saws of all Kinds.
HENRY DISSTON & SONS., " " "
BUFFALO FILE COMPANY, Files of all Kinds.
WHEELER, CLEMSON & CO., " " "
P. S. STUBS, Taper Saw Files.
COE & COMPANY, Genuine Coe Wrenches.
D. MAYDOLE & CO., Hammers of all Kinds.
LAMSON & GOODNOW, Table Cutlery.
NEW YORK KNIFE CO., Pocket Cutlery.
ROGERS BROTHERS, Plated Ware.
PARKER'S Iron and Britannia Spoons and Coffee Mills.

PRATT & CO.,

44, 46, 48 & 50 Terrace, BUFFALO, N. Y.

Hosted by Google

Iron Pipe.

A. Carr	New York	See Page 244
Evans, Dalzell & Co	Pittsburgh, Pa	" 58
Hart, Ball & Hart	Buffalo, N. Y	" 136
J. D. West & Co	New York	" 56
McNab & Harlin Manufacturing Co	" "	" 220
Morris, Tasker & Co	Philadelphia, Pa	" 36
Phelps & Sanger	Cleveland. Ohio	" 120

Iron—Railroad.

See Railroad Iron.

Iron Rods.

Greene & Randolph	New York	See Page 54
Marshall Lefferts, Jr. (Galvanized Iron)	" "	" 41
Rhode Island Nut Co; H. B. Newhall, Agent	" "	" 166

Iron—Sheet.

See Sheet Iron.

Iron Shutters and Doors.

Noyes & Wines	New York	See Page 264

PRUSSIAN RAILWAYS.—2 PAGES.

Regulations for Construction and Rolling Stock.

Railway 4 Feet 8½ Inch Gauge.

Minimum breadth of roadway, double line	24 ft. 9 in.
" " single line	15 ft. 6 in.
Maximum gradient, level districts	1 in 200.
" hilly districts	1 in 100.
" mountainous districts	1 in 40.
Minimum radius of curves, flat districts	3,600 feet.
" " hilly districts	1,200 "
" " mountainous districts	600 "
Maximum guage for straight lines and curves of more than 1,000 feet radius	4 ft. 8½ in.
Maximum guage for round sharp curves	4 ft. 9½ in.
Minimum width of top table of rails	2¼ inches.
Radius of " " from	7 to 5 in.
Minimum depth of rails	4½ inches.
Inclination of rails inwards	1 in 20.
Minimum depth of ballast under sleepers	8 inches.

Level Crossings and Stations.

Minimum angle of crossing, with rails	30°.
" width of channel for flange at crossings	2⅝ inches.
" depth of " " "	1½ "
" portion of level at stations, flat districts	1,800 feet.
" " " mountainous do	600 "
" distance, centre to centre of rail in station	14 "
" radius of crossings and turnouts	600 "
" " for facing points at stations for through trains	1,000 "
" diameter of engine turn-tables	38 "
" width of passenger platforms	18 "
Maximum height	18 inches.
Minimum distance of pillars in stations from rails	9 ft. 5 in.
" diameter of water-crane pipes	6 inches.
" height of fixed portion of water-crane above rails	9 ft. 6 in.

Locomotive Sheds.

Engine pits, in depth, from	2 ft. 6 in. to 3 ft. 6 in.
Minimum height of water tanks above rails	17 feet.
" " engine doorways	15 ft. 9 in.
" width of "	11 feet.
" height of the beams from rails	19 "

Carriage Sheds.

Minimum distance of rail, centre to centre	14 ft. 6 in.
" height of doorways	13 feet.
" width of "	11 "

Hosted by Google

JONAS S. HEARTT & CO.

MANUFACTURERS OF

RAILROAD CAR AND ENGINE WHEELS.

STREET CAR WHEELS,

C. S. BOSWORTH'S PATENT—Best in Use.

☞ AXLES FURNISHED AND FITTED.

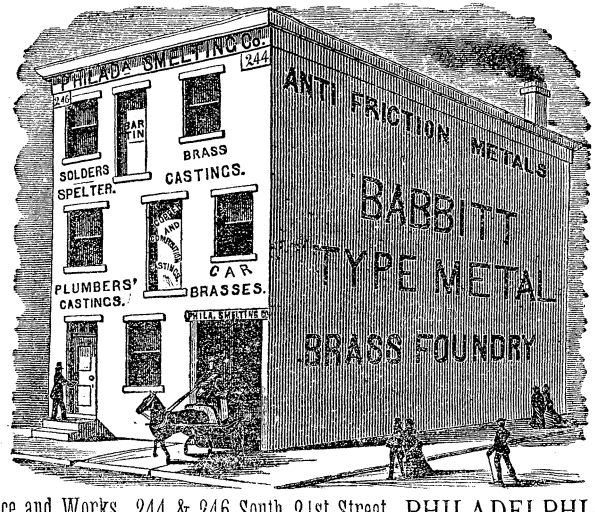
TROY, NEW YORK.

AGENTS FOR SALE OF

GEO. W. SWETT & CO'S.

Shaftsbury Charcoal Pig Iron.

PHILADELPHIA SMELTING COMPANY



Office and Works, 244 & 246 South 21st Street, PHILADELPHIA.

Hosted by Google

Iron Tubing.

Evans, Dalzell & Co	Pittsburgh, Pa	See Page 58
Hart, Ball & Hart	Buffalo, N. Y	" 136
J. J. Walworth	Chicago, Ill	" 124
Morris, Tasker & Co	Philadelphia, Pa	" 36
Phelps & Sanger	Cleveland, Ohio	" 120
Providence Tool Co.; H. B. Newhall, Agent	New York	" 166
Rhode Island Nut Co.; H. B. Newhall, Agent	" "	" 166
Winans & Co	" "	" 106
Wm. Graff & Co	Pittsburgh, Pa	" 174

Iron Wire.

Ansonia Brass & Copper Co	New York	See Page 122
Atwater, Wheeler & Co	New Haven, Conn	" 10
John Merry & Co	New York	" 48
Marshall Lefferts, Jr. (Galvanized Iron)	" "	" 44
Sidney Shepard & Co	Buffalo, N. Y	" 196

PRUSSIAN RAILROADS—Continued.

Locomotives, Speed, &c.

Maximum wheel base of engines, with curves 2,000 ft. radius	15 feet.
" " " " 1,500 "	13 "
" " " " 1,000 "	11 "
Maximum load on one axle	12½ tons.
Minimum play of flanges of wheels	⅜ inches.
" clear space between wheels	4 ft. 5½ in.
Maximum projection of flange below top of rail	1¼ inches.
" width of tyre	6 inches.
Minimum "	5¼ inches.
" diameter of driving wheel for goods engine	4 feet.
" " " " passengers' engine	5 "
" " " " express engine	6 "
" " leading and trailing wheel	3 "
Speed of goods train, per hour	16 miles.
Passenger train, per hour	from 25 to 33 miles.
Express train, per hour	40 miles.
Maximum pressure in boiler, per square inch	100 lbs.
Proof pressure in testing boilers	150 lbs.
Height of life guards above rails	2 to 2½ in.
Maximum breadth of engine	10 feet.
" height of chimney above rails	15 "
Minimum diameter of tender wheels	3 "
Maximum breadth of tender	9 "
" height of tender above rails	8 "

Carriages and Wagons.

Maximum wheel base for curves of 2,000 feet radius	18 feet.
Inclination of cone of tyres	1-20.
Maximum breadth of tyre	6 inches.
Minimum " "	5 "
" thickness of tyre over rail	¾ "
" play for flanges	⅜ "
Maximum "	1 inch.
Clear width between wheels	4 ft. 5½ in.
Maximum projection of flange from surface of rail	1¼ inches.
Minimum diameter of wheels	3 feet.
" " axle at nave, with 5 tons load per axle	4½ inches.
" " axle journal, with 5 tons load	3 "
Length of axle, centre to centre of journal	6 ft. 5½ in.
Maximum length of journal	8 inches.
Minimum " "	5 "
Height of centre of buffers above rails	3 ft. 5 in.
Distance of centre of buffers apart	5 ft. 9 in.
" side chains apart	3 ft. 6 in.
Minimum diameter of buffers	14 inches.
" rounded projection	1 inch.
Maximum breadth of carriage	8 ft. 7 in.
" " wagons	7 feet.
Maximum height of carriages and wagons	12 ft. 4 in.

Hosted by Google

Hart, Ball & Hart,

BUFFALO, N. Y.

WROUGHT IRON PIPE,

FITTINGS, VALVES, COCKS, &c.

All Sizes from ⅛ inch to 8 inch always in Stock.

UNIVERSAL JOINT TELESCOPIC PIPE TANK VALVES,

FOR RAILROAD WATER STATIONS.

STEAM PUMPS and BOILER FEEDERS.

Sounding Tools and Surface Pumps,

FOR COAL MINERS' USE.

BICKFORD, CURTISS & DEMING,

MANUFACTURERS OF THE

"B.C.&D." BELT and HOSE,

FROM PURE OAK LEATHER.

AND DEALERS IN

Lace Leather, Rivets, &c.

53 & 55 EXCHANGE STREET,

BUFFALO, NEW YORK.

Hosted by Google

Iron Working Machinery.

Bolen, Crane & Co	Newark, N. J	See Page 62
Buffalo Machinery Agency	Buffalo, N. Y	" 160
Isaac H. Shearman	Philadelphia, Pa	" 80
L. W. Pond	Worcester, Mass	" 158
Phelps & Sanger	Cleveland, Ohio	" 120
The Atlas Works	Pittsburgh, Pa	" 172
The Pratt & Whitney Co	Hartford, Conn	" 142
Thorne, DeHaven & Co	Philadelphia, Pa	" 38
Wm. B. Bement & Son	" "	" 168
Wm. Sellers & Co	" "	" 64
Winans & Co	New York	" 106

Japans.

Edward Smith & Co	New York	See Page 218
Valentine & Co	" "	" 198

Joints.

Pittsburgh Bolt Co	Pittsburgh, Pa	See Page 118

MEMORANDA ON ENGLISH RAILWAYS.—2 PAGES.

Parliamentary Regulations for Railways Crossing Roads.

	Turnpike Road. ft.	in.	Public Road. ft.	in.	Occupation Road. ft.	in.
Clear width of under bridge or approach	35	0	25	0	42	0
Clear heigth of underbridge for a width of 12 feet	16	0	—	–	—	–
Do., for a width of 10 feet	—	–	45	0	—	–
Do., for a width of 9 feet	—	–	—	–	44	0
Do., at springing	12	0	42	0	—	–
Over bridge. Height of parapets	4	0	4	0	4	0
Approaches. Inclination	4 in 30		4 in 20		4 in 46	
Approaches. Height of fencing	3	0	3	0	3	0

	Narrow. ft.	in.	Broad. ft.	in.
Average formation width, single line	48	0	24	6
" " " double line	30	0	38	0
Average width of top ballast, single line	43	6	45	6
" " " double line	24	6	29	0

Formation slope from centre in cuttings, 1 in 30.
Width of land taken beyond bottom o slope, from 9 to 12 feet.
Ditch with slopes 1 to 1, 1 foot wide at bottom.
Quick mound, 1 foot 6 inches high.
Post and rail fencing posts, 9 feet apart, 3 feet in the ground. 4 rails, 4 × 1½.
Dimensions of do., 7 feet 6 inches × 6 inches × 3½.
Intermediate posts, 3 feet apart, 5 feet 6 inches × 4 × 1½.

Board of Trade Regulations for Railways.

Main Line.

Breaking weighth of cast-iron girders to be made = permanent load × 3 + moving load × 6.
Wrought-iron bridges must not be strained to more than 5 tons per square inch when loaded with the heaviest engines.
Minimum distance of standing work from the outer edge of rail at level of carriage steps = 3 feet 6 inches in England = 4 feet in Ireland.
Minimum distance between lines of railway = 6 feet.

Stations.

Minimum width of platforms = 6 feet.
" distance of columns from edge of platform = 6 feet.
Steepest gradient recommended for stations = 1 in 300.

Carriages.

Minimum space per passenger = 20 cubic feet.
" area of glass per passenger = 60 superficial inches.
" width of seats = 15 inches.
" breadth of seat per passenger = 16 inches.
" number of lamps per carriage = 2.

Hosted by Google

ESTABLISHED 1820.

WILLIAM J. YOUNG & SONS,

MATHEMATICAL

AND

ENGINEERING

INSTRUMENT MANUFACTURERS.

No. 43 North Seventh St., PHILADELPHIA.

IMPROVED TRANSITS and LEVELS, TAPES, CHAINS, DRAUGHTING INSTRUMENTS.

STATIONERY, ALL SUPPLIES FOR **Field and Office.**

T. B. BICKERTON & CO.

Railroad, Machinists' & Engineers'

SUPPLIES.

No. 12 SOUTH FOURTH STREET,

PHILADELPHIA.

SHAFTING
A SPECIALITY.

PAT. INTERNAL
CLAMP COUPLING

PAT. VISE COUPLINGS

SHAFTING
From $\frac{15}{16}$ to $5\frac{15}{16}$ in. DIAM.

LOOSE COLLARS. FAST COLLARS

STEEL SHAFTING made to order

LARGE STOCK of FINISHED PULLEYS
always on hand.

GEO. V. CRESSON,
Cor. 18th & Hamilton Sts.
PHILADELPHIA, PA.

EVERY DESCRIPTION
of
FIXTURES
used in
TRANSMISSION
Of Steam Power.

Pat. Improved
Ball and Socket
Adjustable
Hangers.

Hosted by Google

Journal Bearings.

G. W. W. Stevens & Co.....New York.....See Page 8
John Harden..... " " ..... " 230

Knife Grinders.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Lace Leather.

Bickford, Curtiss & Deming.....Buffalo, N. Y.....See Page 136
N. H. Gardner & Co..... " " ..... " 254

Ladies.

Wm. B. Bement & Son.....Philadelphia, Pa..... See Page 168

Lag Screws.

Lewis Oliver & Phillips; H. B. Newhall, Agt...New York.....See Page 166
Pittsburgh Bolt Co.....Pittsburgh, N. Y..... " 118
Providence Tool Co.; H. B. Newhall, Agent....New York..... " 166

Lamp Posts.

Morris, Tasker & Co.....Philadelphia, Pa.....See Page 36
R. A. Brick & Co.....New York..... " 48

MEMORANDA ON ENGLISH RAILWAYS—CONTINUED.

Requirements.

Joints of rails to be fished.
Chairs to be secured by iron spikes.
Fang bolts to be used at the joints of flat-bottomed rails.

Stations.

Ends of platforms to be ramped (not *stepped*).
Signals and distant signals in both directions.
Signals to be weighted to fly to "danger" if wire breaks.
Switch handles to be brought together.
" not to be worked between lines of rail.
Facing points to be avoided
" where unavoidable, to be furnished with self-acting signal.
Sidings to be supplied with locked chock-block.
Sidings on a gradient falling towards the line to be provided with a blind siding.
Turn-tables to be a safe distance from adjacent lines.
Platforms of bridges protected from fire.
Walls and handrails to be provided on viaducts at stations.
Level crossing gates to be capable of being closed across both road and railway.
Clocks visible at all stations.
Mile posts and gradient boards.
Tunnels and dangerous places protected by telegraph.

RECIPES FOR SEALING WAX.

Red.

Shellac	4	ounces.
Venice turpentine	1¼	"
Vermilion	3	"

Black.

Shellac	60	parts.
Fine ivory black	30	"
Venice turpentine	30	"

Yellow.

Shellac	4	ounces.
Resin	1¼	"
Venice turpentine	2	"
Sulphuret of arsenic	¼	"

Brown.

Shellac	7½	ounces.
Venice turpentine	4	"
Brown ochre	1	"
Vermilion	½	"

Blue.

Fine shellac	7	ounces.
Venice turpentine	3	"
Resin	1	"
Mineral Blue	1	"

Green.

Shellac	4	ounces.
Venice turpentine	2	"
Resin	1¼	"
Sulphuret of arsenic	¼	"
Mineral blue	¼	"

Melt the shellac at the lowest necessary temperature; stir the turpentine previously warmed; and then add the colors, and pour into moulds

Hosted by Google

Skinner & Gifford Manf'g Co.

Office and Works, Cor. Talcott St. & Railroad Avenue,

DUNKIRK, NEW YORK,

MANUFACTURERS OF

Self-Acting Hoisting Machines,

FOR LOCOMOTIVES AND CARS.

HAND, PUSH AND DUMP CARS,

IRON AND WOODEN TURNTABLES,

Portable and Stationary.

WRECKING DERRICKS,

WATER TANK VALVES,

Railway and Contractors' Track Supplies,

Frogs, Switches, Steel Scrapers, Cold Chisels,

Claw and Tamping Bars, Spike Mauls,

Bridge Bolts and Castings---All Sizes.

DESIGNS AND ESTIMATES FOR

Iron Roof Trusses and Cast Iron Fronts,

FOR ROUND HOUSES and DEPOTS, Furnished on Application.

☞ Send for Illustrated Catalogue and Price List.

Hosted by Google

Lamps.

Ansonia Brass & Copper Co	New York	See Page 122
Buffalo Steam Gauge Co	Buffalo, N. Y	" 170
J. G. Knapp Manufacturing Co	New York	" 16
L. G. Tillotson & Co	" "	" 94
S. M. Aikman & Co	" "	" 114
Vose, Dinsmore & Co	" "	" 60

Lanterns.

Buffalo Steam Gauge Co	Buffalo, N. Y	See Page 170
L. G. Tillotson & Co	New York	" 94
Parmelee & Bonnell	Buffalo, N. Y	" 202
Orrin L. Gridley	" "	" 196
Radley & McAlister Manufacturing Co	New York	" 250
S. M. Aikman & Co	" "	" 114
T. B. Bickerton & Co	Philadelphia, Pa	" 138
Vose, Dinsmore & Co	New York	" 60

STANDARD SIZES OF NUTS.

Square Nuts.

Width.	Thickness.	Hole.	Size of Bolt.
1/2	1/4	7-32	1/4
5/8	5/16	9-32	5/16
3/4	3/8	11-32	3/8
7/8	7/16	13-32	7/16
1	1/2	7/16	1/2
1	1/2	1/2	1/2
1 1/8	1/2	9/16	9/16
1 1/8	5/8	5/8	5/8
1 1/4	5/8	9/16	5/8
1 3/8	3/4	11/16	3/4
1 1/2	3/4	11/16	3/4
1 5/8	7/8	13/16	7/8
1 3/4	7/8	13/16	7/8
1 3/4	1	29-32	1
2	1	29-32	1
2	1 1/8	1	1 1/8
2 1/4	1 1/8	1	1 1/8
2 1/4	1 3/8	1 1/8	1 1/8
2 1/4	1 1/4	1 1/8	1 1/4
2 1/2	1 3/8	1 1/4	1 3/8
2 3/4	1 1/2	1 3/8	1 1/2
3	1 5/8	1 7/16	1 5/8
3 1/4	1 3/4	1 9/16	1 3/4
3 1/2	1 7/8	1 11/16	1 7/8
4	2	1 13/16	2

Hexagon Nuts.

Width.	Thickness.	Hole.	Size of Bolt.
7/8	3/8	11-29	3/8
3/4	1/2	7/16	1/2
1	1/2	7/16	1/2
1 1/8	5/8	9/16	5/8
1 1/4	3/4	11/16	3/4
1 3/8	3/4	11/16	3/4
1 3/8	7/8	13/16	7/8
1 5/8	7/8	13/16	7/8
1 5/8	1	29-32	1
1 3/4	1	29-32	1
1 3/4	1 1/8	1	1 1/8
2	1 1/4	1	1 1/4
2 1/4	1 3/8	1 1/8	1 3/8
2 1/2	1 1/2	1 1/4	1 1/2
2 3/4	1 5/8	1 3/8	1 5/8
3	1 3/4	1 7/16	1 3/4
3 1/4	1 7/8	1 9/16	1 7/8
3 1/2	2	1 11/16	2
3 1/2	2	1 13/16	2

NUMBER OF NUTS OF EACH SIZE TO 100 POUNDS.

	Cold Punched Nuts. Square.	Cold Punched Nuts. Hexagon.	Hot Pressed Nuts. Square.	Hot Pressed Nuts. Hexagon.
3/8-in.	1945	3010	1090	1240
1/2 "	810	810	540	645
5/8 "	425	450	370	420
3/4 "	243	265	225	253
7/8 "	166	160	145	165
1 "	110	105	95	115
1 1/8 "	80	80	68	83
1 1/4 "	67	60	43	50
1 1/2 "	32	30		

STANDARD LIGHT SIZES, HOT PRESSED, SQUARE AND HEXAGON NUTS.

Short Diam.	Thickness.	Hole.	Size of Bolt.
5/8	3/8	21-64	3/8
3/4	7/16	3/8	7/16
7/8	1/2	7/16	1/2
1	9/16	1/2	9/16
1 1/8	5/8	9/16	5/8
1 1/4	3/4	21-32	3/4
1 1/2	7/8	49-64	7/8
1 3/4	1	7/8	1
2	1 1/8	1	1 1/8
2 1/4	1 3/8	1 1/4	1 3/8
2 1/2	1 1/2	1 3-32	1 1/2
2 3/4	1 5/8	1 7-32	1 5/8
2 3/4	1 1/2	1 5/16	1 1/2

Hosted by Google

THE PRATT & WHITNEY CO.,

HARTFORD, CONN.,

MANUFACTURERS OF

Engine Lathes, With Slate's Patent Taper Attachment.

Boring Mills, Shaping Machines,

Planers, Drills,

AND OTHER *Machinists' Tools,*

Gun and Sewing Machine Machinery, Friction Clutch Pulleys, &c.

☞ SEND FOR DESCRIPTIVE PAMPHLET. ☜

NEW HAVEN NUT CO.

MANUFACTURERS OF

PATENT

HOT PRESSED NUTS,

P. O. ADDRESS,

WESTVILLE, CONN.

L. P. WOODWORTH, Superintendent.

J. D. PAYNE, S c'y and Treas.

THREE FIRE ENGINES

AT A BARGAIN.

One Steamer, fitted for Horses, Prince's Metal Jacket, very powerful and highly finished.

One Steamer, fitted for Horses, Sheet Iron Jacket.

One Single Pump Steamer, drawn by Hand, Sheet Iron Jacket.

☞ All built by *The Allerton Iron Works Manufacturing Co.,* and will be sold at very low prices.

ADDRESS GEORGE M. ALLERTON,

205 BROADWAY, NEW YORK.

Hosted by Google

Lard Oil.

F. S. Pease.....Buffalo, N. Y.....See Page 100
P. H. Moffat.....Chicago, Ill..... " 190

Lathe Centre Grinders.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Lathe Chucks.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Lathe Dogs.

Champlin & Rogers.....Chicago, Ill.....See Page 192
The Worcester Machine Screw Co.; H. B. Newhall, Agent.....New York.....See Page 166

Lathes.

Bolen, Crane & Co.....Newark, N. J.....See Page 62
Isaac H. Shearman.....Philadelphia, Pa..... " 80
L. W. Pond.....Worcester, Mass..... " 158
Phelps & Sanger.....Cleveland, Ohio..... " 120
The Buffalo Machinery Agency.....Buffalo, N. Y..... " 160
The Pratt & Whitney Co.....Hartford, Conn..... " 142
Wm. B. Bement & Son.....Philadelphia, Pa..... " 168
Wm. Sellers & Co..... " " ..... " 64

Lead.

Bruce & Cook.....New York.....See Page 112
E. W. Blatchford & Co.....Chicago, Ill..... " 124
Holmes & Lissberger.....New York..... " 84
Philadelphia Smelting Co.....Philadelphia, Pa..... " 134

STANDARD SIZES OF WASHERS.

Diam.	Size of Hole.	Thickness, Wire Guage.	Size of Bolt.	Diam.	Size of Hole.	Thickness, Wire Guage.	Size of Bolt.
1/2	1/4	No. 18	3/16	1 3/4	11/16	No. 10	5/8
5/8	9/16	" 18	1/4	2	13/16	" 10	3/4
3/4	5/16	" 16	1/4	2 1/4	15/16	" 9	7/8
7/8	3/8	" 16	5/16	2 1/2	1 1/16	" 9	1
1	7/16	" 14	3/8	2 3/4	1 1/4	" 9	1 1/8
1 1/4	1/2	" 14	7/16	3	1 3/8	" 9	1 1/4
1 3/8	9/16	" 12	1/2	3 1/2	1 1/2	" 9	1 3/8
1 1/2	5/8	" 12	9/16				

NUMBER OF WASHERS IN 100 POUNDS.

Size.	No. to 100 lbs.	Size.	No. to 100 lbs.
3/8	5715	1	940
1/2	4010	1 1/8	510
5/8	2235	1 1/4	415
3/4	1450	1 1/2	335
7/8	1185		

TEMPERING STEEL. (*Haswell.*)

Steel in its hardest state being too brittle for most purposes, the requisite strength and elasticity are obtained by tempering—or *letting down the temper*, as it is termed—which is performed by heating the hardened steel to a certain degree and cooling it quickly. The requisite heat is usually ascertained by the color which the surface of the steel assumes from the film of oxide thus formed. The degrees of heat to which these several colors correspond are as follows:

At 430°, a very faint yellow At 450°, a pale straw color..	Suitable for hard instruments; as hammer-faces, drills, &c.
At 470°, a full yellow..... At 490°, a brown color.....	For instruments requiring hard edges without elasticity; as shears, scissors, turning tools, &c.
At 510°, brown, with purple spots..... At 538°, purple.....	For tools for cutting wood and soft metals; such as plane-irons, knives, &c.
At 550°, dark blue ..... At 560°, full blue.....	For tools requiring strong edges without extreme hardness; as cold-chisels, axes, cutlery, &c.
At 600°, grayish-blue, verging on black.....	For spring-temper, which will bend before breaking; as saws, sword-blades, &c.

If the steel is heated higher than this, the effect of the hardening process is destroyed.

Hosted by Google

ROGERS & CO.

DEALERS IN

Wrought Iron Beams,

GIRDERS,

T and Angle Iron,

MERCHANT'S BAR IRON.

Scotch Pig,

Lake Superior Charcoal,

Missouri Charcoal, and

Bituminous Pig Iron.

Lump Lehigh Coal,

(FOR FOUNDRY USE.)

Blossburg Coal,

(FOR BLACKSMITH'S USE.)

Lackawanna Coal,

Nut, Range, Small Egg and Large Egg.

FIRE BRICK AND FIRE CLAY COAL FACING.

144 Market Street,

CHICAGO, ILL.

Hosted by Google

Lead Pipe.

Bruce & Cook.....New York.....See Page 112
E. W. Blatchford & Co.....Chicago, Ill..... " 124

Learners' Telegraph Instruments.

M. A. Buell..... .....Cleveland, Ohio.....See Page 46

ANGLE AND T IRON.—2 PAGES.

Weight of Running Foot in Pounds.

Weights of ⊔ (channel) and ⊢⊣ iron may be found from the Table of Angle and T iron in the following manner, provided the web and flanges are of the same mean thickness:

Let the number of the side column referred to equal half the sum of the depth of web and breadth of both flanges; then twice the weight corresponding thereto will be the weight per lineal foot, according to the thickness, of the channel or ⊢⊣ iron required.

Sum of width of Flanges.	Thickness in Fractions of an Inch.									
Ins.	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4
2	1.13	1.46	1.76	2.03	...	...	...	...	...	...
1/8	1.21	1.56	1.89	2.19	...	...	...	...	...	...
1/4	1.29	1.67	2.02	2.34	...	...	...	...	...	...
3/8	1.37	1.77	2.15	2.5	...	...	...	...	...	...
1/2	1.45	1.88	2.28	2.66	3.01	...	...	...	...	...
5/8	1.52	1.98	2.41	2.81	3.19	...	...	...	...	...
3/4	1.6	2.08	2.54	2.92	3.37	...	...	...	...	...
7/8	1.68	2.19	2.67	3.13	3.55	...	...	...	...	...
3	1.76	2.29	2.8	3.28	3 74	4.17	...	...	...	...
1/8	1.84	2.4	2.93	3.44	3.92	4.37	...	...	...	...
1/4	1.91	2.5	3.06	3.59	4.1	4.58	...	...	...	...
3/8	1.99	2.6	3.19	3.75	4.28	4.79	...	...	...	...
1/2	2.07	2.71	3.32	3 91	4.47	5.	5.51	...	...	...
5/8	2.15	2.81	3.45	4.06	4.65	5.21	5.74	...	...	...
3/4	2.23	2.92	3.58	4.22	4.83	5.42	5.98	...	...	...
7/8	2.3	3 02	3.71	4.38	5.01	5.63	6.21	...	...	...
4	2.38	3.13	3.84	4.53	5.2	5.83	6.45	7.04	...	...
1/8	2.46	3.23	3.97	4.69	5.38	6.04	6.68	7.29	...	...
1/4	2.54	3.33	4.1	4.84	5.56	6 25	6.91	7.55	...	...
3/8	2.62	3 44	4.23	5.	5.74	6.46	7.15	7.81	...	...
1/2	2.7	3.54	4.36	5.16	5.92	6.67	7.38	8.07	...	...
5/8	2.77	3.65	4.49	5.31	6.11	6.87	7.62	8.33	9 02	...
3/4	2.85	3.75	4.62	5.47	6.29	7.08	7.85	8.59	9.31	...
7/8	2.93	3.85	4.75	5.62	6.47	7.29	8.09	8.85	9.6	...
5	3.01	3.96	4.88	5.78	6.65	7.50	8.32	9.11	9.88	10.62
1/8	3.09	4.06	5.01	5.94	6.84	7.71	8.55	9.37	10.17	10.94
1/4	3.16	4.17	5.14	6.09	7.02	7.91	8.79	9 63	10.45	11.25
3/8	3.24	4.27	5.27	6.25	7.2	8.12	9.02	9.9	10.74	11.56
1/2	3.32	4.37	5.4	6.41	7.38	8.33	9 26	10.16	11.03	11.87
5/8	3.4	4.48	5.53	6.56	7.56	8.54	9.49	10.42	11.31	12.19
3/4	3.48	4.58	5.66	6.72	7.75	8.75	9.73	10.68	11.6	12.5
7/8	3.55	4.69	5.79	6.87	7.93	8.96	9.96	10.94	11.89	12.81
6	3.63	4.79	5.92	7.03	8.11	9.17	10.19	11.2	12.17	13·12
1/8	3 71	4.9	6.05	7.19	8.29	9.37	10.43	11.46	12.46	13.43
1/4	3.79	5.	6.18	7.34	8.48	9.58	10.66	11.72	12.74	13.75
3/8	3.87	5.1	6.32	7.5	8.66	9 79	10.9	11.98	13.03	14.06
1/2	3.95	5.21	6.45	7.66	8.84	10.	11.13	12.24	13.32	14 37
5/8	4.02	5.31	6.58	7.81	9.02	10.21	11.37	12.5	13.6	14.68
3/4	4.1	5.42	6.71	7.97	9.21	10.42	11.6	12.76	13.89	15.
7/8	4.18	5.52	6.84	8.13	9.39	10.63	11.84	13.02	14.18	15.31

Hosted by Google

ESTABLISHED 1845.

GEO. C. FISK, President. *H. S. HYDE, Treasurer.*

WASON MANUFACTURING CO.

SPRINGFIELD, MASS.,

BUILDERS OF ALL DESCRIPTIONS OF

RAILWAY CARS,

MANUFACTURERS OF

CAR WHEELS

AND

RAILWAY CASTINGS

☞ Particular attention paid to the Shipment of Cars, and Materials for Cars, to all parts of the world.

Hosted by Google

Leather Belting.

A. Carr	New York	See Page	244
Bickford, Curtiss & Deming	Buffalo, N. Y	"	136
Buffalo Machinery Agency	Buffalo, N. Y	"	160
Darrow, Turner & Co	New York	"	62
J. J. Walworth	Chicago, Ill	"	124
N. H. Gardner & Co	Buffalo, N. Y	"	254
Radley & McAlister Mfg. Co	New York	"	250
Vose, Dinsmore & Co	"	"	60
William Green & Co	Wilmington, Del.	"	248

ANGLE AND T IRON.—Continued.

Weight of Running Foot, in Pounds.

See Note at head of this Table.

Sum of width of Flanges.	Thickness in Fractions of an Inch.									
Ins.	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	7/8	1
7	6.97	8.28	9.57	10.83	12.07	13.28	14.47	15.62	17.86	20.
1/8	7.10	8.44	9.75	11.04	12.3	13.54	14.75	15.93	18.23	20.42
1/4	7.23	8.59	9.93	11.25	12.54	13.8	15.04	16.25	18.59	20.83
3/8	7 36	8.75	10.12	11.46	12.77	14.03	15.33	16.56	18.96	21.25
1/2	7.49	8.91	10.3	11.67	13.01	14.32	15.61	16.87	19.32	21.67
5/8	7.62	9.06	10.48	11.87	13.24	14.58	15.9	17.19	19.69	22.08
3/4	7.75	9.22	10.66	12.08	13.48	14.84	16.18	17.5	2[illegible].05	22 5
7/8	7.88	9.37	10.85	12.29	13.71	15.1	16.47	17.81	20.42	22.92
8	8.01	9.53	11.03	12.5	13.94	15.36	16.76	18.12	20.78	23 33
1/8	8.14	9.69	11.21	12.71	14.18	15.62	17.04	18.44	21.15	23.73
1/4	8.27	9.84	11.39	12.92	14.41	15.88	17.33	18.75	21.51	24.16
3/8	8.40	10.	11.57	13.12	14.65	16.15	17.62	19.06	21.87	24.58
1/2	8.53	10.16	11.76	12.33	14.88	16.41	17.9	19.37	22.24	25.
5/8	8.66	10.31	11.94	13.54	15.12	16.67	18.19	19.69	22.6	25.41
3/4	8.79	10.47	12.12	13.75	15.35	16.93	18.47	20.	22.97	25.83
7/8	8.92	10.62	12.3	13.96	15.58	17.19	18.76	20.31	23.33	26.25
9	9.05	10.78	12.49	14.17	15.82	17.45	19.05	20.62	23.7	26.66
1/4	9.31	11.09	12.85	14.58	16.29	17.97	19.62	21.25	24.42	27.50
1/2	9.57	11.41	13.22	15.	16.76	18.49	20.19	21.87	25.15	28.33
3/4	9.83	11.72	13.58	15.42	17.23	19.01	20.77	22.50	25.88	29.16
10	10.09	12.03	13.95	15.83	17.7	19.53	21.34	23.12	26.61	30.
1/4	10.35	12.34	14.31	16.25	18.16	20.05	21.91	23.75	27.34	30.83
1/2	10.61	12.66	14.67	16.67	18.63	20.57	22.49	24.37	28.07	31.67
3/4	10.87	12.97	15.04	17.08	19.1	21.09	23.06	25.	28.8	32.5
11	11.13	13.28	15.4	17.5	19.57	21.61	23.63	25.62	29.53	33.33
1/4	11.39	13.59	15.77	17.92	20.04	22.13	24.2	26.25	30.26	34.17
1/2	11.65	13.91	16.13	18.33	20.51	22.66	24.78	26.87	30.99	35.
3/4	11.91	14.22	16.5	18.75	20.98	23.18	25.35	27.5	31.72	35.83
12	12.17	14.53	16.86	19.17	21.44	23.7	25.92	28.12	32.45	36. 7
1/4		14.84	17.23	19.58	21.91	24.22	26.5	28.75	33.17	37.5
1/2		15.16	17.59	20.	22.38	24.74	27.07	29.37	33.9	38.33
3/4			17.96	20.42	22.85	25.26	27.64	30.	34.63	39.16
13			18.32	20.83	23.32	25.78	28.22	30.62	35.36	40.
1/4				21.25	23.79	26.3	28.79	31.25	36.09	40.83
1/2				21.67	24.26	26.82	29.36	31.87	36.82	41.67
3/4				22.08	24.73	27.34	29.93	32.5	37.55	42.5
14				22.5	25.19	27.86	30.51	33.12	38.28	43.33
1/4				22.92	25.66	28.38	31.08	33.75	39.01	44.17
1/2				23.33	26.13	28.91	31.65	34.37	39.74	45.
3/4				23.75	26.6	29.43	32.22	35.	40.47	45.83
15				24.17	27.07	29.95	32.8	35.62	41.2	46.67

Hosted by Google

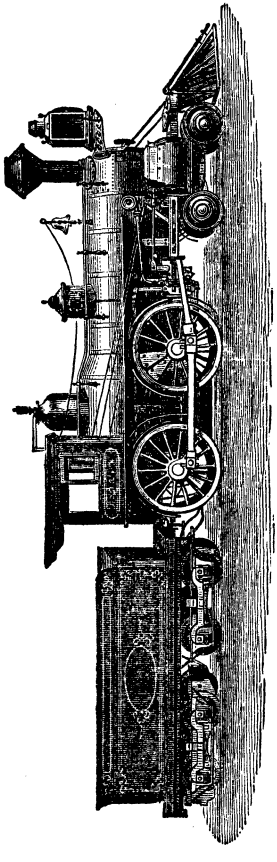
RAILROAD MACHINERY,

TIRES, &c., &c.

JOHN C. ELLIS, Prest. *CHAS. G. ELLIS, Treas.* *WALTER McQUEEN, Sup't.*

SCHENECTADY LOCOMOTIVE WORKS,

Schenectady, N. Y.,



Continue to receive orders, and to furnish with promptness the best and latest Improved

Coal or Wood Burning Locomotive Engines.

ALSO

REPAIR AND REBUILD LOCOMOTIVES.

☞ The above Works, located on the N. Y. C. R. R., near the centre of the State, possess superior facilities for forwarding work to any part of the country.

Hosted by Google

Leather Hose.

A. Carr.....New York.....See Page 244
Bickford, Curtiss & Deming.....Buffalo, N. Y..... " 136
Darrow, Turner & Co.....New York..... " 62
Vose, Dinsmore & Co..... " " ..... " 60

Leather of All Kinds.

Wm. Green & Co.....Wilmington, Del.....See Page 248

ADHESIVE POWER OF LOCOMOTIVES.

Adhesion per Ton of Load on the Driving Wheels:

When the rails are very dry..... 600 lbs. per ton.
When the rails are very wet..... 550 " "
In misty weather if the rails are greasy.. 300 " "
In frosty or snowy weather..... 200 " "

In coupled engines the adhesive force is due to the load on all wheels coupled to the driving wheels.

The adhesive power must exceed the tractive force of an engine on the rails, otherwise the wheels will slip. For loads on driv ng wheels, see below.

DISTRIBUTION OF WEIGHT IN LOCOMOTIVES.

The average distribution of the weights of a six-wheeled locomotive on its wheels is:

Assuming the total weight of the engine in working order to be 1;

	Passenger Engines.		Freight Engines.
Load on leading wheels.....	.32	.....	.34
" driving wheels.....	.48	.....	.36
" trailing wheels.....	.20	.....	.30
Total weight of engine.....	100	.....	100

Passenger engines, narrow gauge, average... from 20 to 30 tons.
Freight engines..... " 24 to 32 "
Broad-gauge engines, first class..... " 35 "
Incline engines..... " 40 to 47 "

TRACTIVE POWER OF LOCOMOTIVES.

Let D = Diameter of cylinder in inches.
" P = Mean pressure of steam in cylinders in lbs. per square inch.
" L = Length of stroke in inches.
" W = Diameter of driving wheel in inches.

Tractive force on rails in lbs. will equal $\frac{D^2 P L}{W}$.

EFFECTIVE PRESSURE OF STEAM ON PISTON.

With Different Rates of Expansion.—Boiler Pressure being assumed at 100 lbs. per square inch.

			Effective pressure.
Steam cut off at	¾	of stroke	= 90
"	⅔	"	= 80
"	½	"	= 69
"	⅓	"	= 50
"	¼	"	= 40

TO FIND THE LOAD WHICH AN ENGINE WILL TAKE ON A GIVEN INCLINE.

Let G = Resistance due to gravity on the steepest gradient in lbs. per ton. See page 151.
" R = Resistance due to assumed velocity of train in lbs. per ton. See page 151.
" T = Tractive power of engine in lbs. as found above.
" W = Weight of engine and tender in tons.

The load the engine can take in tons, including the weight of the waggons, but not that of engine and tender will equal $\frac{T}{G + R} = W$.

Hosted by Google

PITTSBURGH STEEL WORKS.

ANDERSON & WOODS,

PITTSBURGH, PA.

REVERSIBLE STEEL FROGS,

Best Refined Tool Steel,

R. R. Cast Spring Steel,

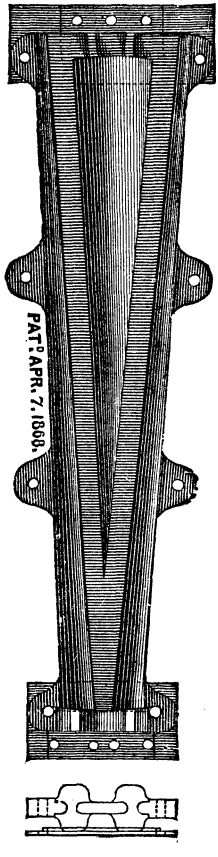
Frog Points, Side Bars,

Slide Bars, Connecting Rods,

Locomotive and Car Axles,

Crank Pins, Piston Rods,

Cast Steel Crow Bars.



FORGINGS

OF ANY DESCRIPTION MADE TO ORDER.

FROGS AND CROSSINGS

MADE TO ANY ANGLE.

OUR FROGS

ARE NOW IN USE on the FOLLOWING ROADS:

Lake Shore & Michigan Southern Railroad.
New York Central & Hudson River Railroad.
Allegheny Valley Railroad.
Pittsburgh, Washington & Baltimore Railroad.
Wisconsin Central Railroad.
Louisville & Nashville Railroad.
Oil Creek & Allegheny River Railroad.
Union Railway.
Houghton & Ontonagon Railroad.
St. Louis & Iron Mountain Railroad.
Atlantic & Pacific Railroad.

Hosted by Google

Levels.

F. Eckel.....New York.....See Page 76
Kuebler & Seelhorst.....Philadelphia, Pa..... " 216
Wm. J. Young & Sons ..... " "..... " 138

Lightning Rods.

J. D. West & Co.....New York..... .....See Page 56

Light Locomotives.

Porter, Bell & Co.....Pittsburgh, Pa.....See Page 128

Lime Kiln Blocks.

Philip Neukumet.....Philadelphia, Pa.....See Page 104

Linen Hose.

A. Carr.....New York.....See Page 244

TABLE OF GRADIENTS

AND RESISTANCE DUE TO GRAVITY PER TON, FOR EACH.

(*Haslett.*)

Vertical Rise. Ratio. one in	Pr. Mile. feet.	Resistance Per Ton. lbs.	Vertical Rise. Ratio. one in	Pr. Mile. feet.	Resistance Per Ton. lbs.
100	52.8	22.4	60	88.	37.3
98	53.9	22.8	58	91.	38.6
96	55.	23.3	56	94.2	40.
94	56.1	23.8	54	97.7	41.4
92	57.5	24.3	52	101.5	43.
90	58.6	24.9	50	105.6	44.8
88	60.	25.4	48	110.	46.6
86	61.3	26.	46	115.	48.6
84	62.8	26.6	44	120.	50.9
82	64.3	27.3	42	125.7	53.3
80	66.	28.	40	132.	56.
78	67.6	28.7	38	138.9	58.9
76	69.4	29.4	36	146.6	62.2
74	71.3	32.2	34	155.3	65.8
72	73.3	31.1	32	165.	70.
70	75.4	32.	30	176.	74.6
68	77.6	32.9	28	188.5	80.
66	80.	33.9	26	203.	86.1
64	82.5	35.	24	220.	93.3
62	85.1	36.1	22	240.	101.8

RESISTANCE OF TRAINS, ON A LEVEL.

AT DIFFERENT SPEEDS, IN LBS. per TON OF LOAD.

(*Molesworth.*)

V = Velocity in miles per hour.
R = Resistance in lbs. per ton of train.

$$R = \frac{V^2}{171} + 8.$$

The resistance of curves may be reckoned as 1 per cent. for each degree of the curve occupied by the train.

Imperfections of road vary from 5 to 40 per cent.

Strong side winds..... 20 "

Velocity of train in miles per hour.	10	15	20	30	40	50	60	70
Resistance on straight line in lbs. per ton...	8½	9¼	10¼	13¼	17¼	22½	29	36½
Do., with sharp curves and strong wind*....	13	14	15½	20	26	34	43½	55

* 50 per cent added to resistance on straight line.

Hosted by Google

HERMANN BOKER & CO.

PROPRIETORS OF

THE TRENTON VISE and TOOL WORKS,

AND IMPORTERS OF

German and English Hardware,

101 & 103 DUANE STREET,

AND

91 & 93 THOMAS STREET,

NEW YORK.

Coil and Cable Chains,
Steel Tyres,
Fish Bars,
Anvils.

Spiegeleisen,
Files and Tools,
F. & E. Steel Rails,
C Steel Bells for
Stations, Ferries and Towers.

SOLE AGENTS FOR THE

H. BOKER'S Unrivalled Scissors, Pocket Cutlery & Hardware.
Sole Agent of the Celebrated Gimlet Bit, No. 679.
PETER WRIGHT'S Anvils, Trace and Coil Chains.
STUBS' Taper Saw Files, Adams' Punches.
BUTCHERS' Files, Tools and Razors, "Goodlad" Files.
BRADE'S Trowels, Hedge Shears, Spurs, Curry Combs.
MANHATTAN Cutlery and "O. K." Razors.
LAMSON & GOODNOW M'F'G CO., Table & Butchers' Knives.
WILSON'S Butcher Knives and Steels.
LINACRE'S Grass Hooks and Grain Sickles.
T. WALDRON'S Scythes and Straw Knives.
ENGLISH and GERMAN Guns, Caps, &c.
GERMAN Halter and Coil Chains.

SEND FOR AN ILLUSTRATED PRICE LIST.

Hosted by Google

Linseed Cake.

Campbell & Thayer.....New York.....See Page 264

Linseed Oil.

Atlantic White Lead Co.—Rob't Colgate & Co. New York.....See Pages 238, 240
Campbell & Thayer..... " " .....See Page 264
C. E. Hecht.....Easton, Pa..... " 158
E. W. Blatchford & Co.....Chicago, Ill..... " 124
F. S. Pease.....Buffalo, N. Y..... " 100
John Jewett & Son.....New York.....See Pages 72, 74

Litharge.

Atlantic White Lead Co.—Rob't Colgate & Co. New York.....See Pages 238, 240
Brooklyn White Lead Co.....New York.....See Page 268
Wetherill & Bro.....Philadelphia, Pa..... " 52

Lithography.

Allen, Lane & Scott.....Philadelphia, Pa.....See Page 90
Chas. F. Ketcham.....New York..... " 262
Warren, Johnson & Co .....Buffalo, N. Y..... " 100

Local and Coupon Tickets.

Allen, Lane & Scott.....Philadelphia, Pa.....See Page 90
Warren, Johnson & Co.....Buffalo, N.Y..... " 100

SHELLS OF BOILERS.

Resistance to Internal or Bursting Pressure.

(From Haswell.)

Diameter.	Thickness.	Bursting Pressure per Square Inch. Single Riveted.	Double Riveted.	Diameter.	Thickness.	Bursting Pressure per Square Inch. Single Riveted.	Double Riveted.
Feet.	Ins.	Lbs.	Lbs.	Feet.	Ins.	Lbs.	Lbs.
2	1/4	573	745	7.6	5/16	191	248
2.6	1/4	458	596	7.6	3/8	229	298
3	1/4	382	496	8	5/16	179	233
3.4	1/4	318	414	8	3/8	215	279
3.4	5/16	398	518	8.6	5/16	168	219
3.6	1/4	327	426	8.6	3/8	202	263
3.6	5/16	409	532	9	5/16	159	207
4	1/4	286	372	9	3/8	191	248
4	5/16	358	465	9.6	5/16	150	196
4.6	1/4	254	331	9.6	3/8	181	235
4.6	5/16	318	413	10	5/16	143	186
5	1/4	229	298	10	3/8	172	224
5	5/16	286	372	10	1/2	229	298
5.6	1/4	208	270	10.6	5/16	136	177
5.6	5/16	260	338	10.6	3/8	163	212
5.6	3/8	312	406	10.6	1/2	218	284
6	1/4	191	248	11	3/8	156	203
6	5/16	239	311	11	1/2	208	271
6	3/8	286	372	11.6	3/8	149	194
6.6	5/16	220	287	11.6	1/2	199	259
6.6	3/8	264	344	12	3/8	143	166
7	5/16	204	266	12	1/2	191	248
7	3/8	245	319				

Tensile resistance of the plates without Riveting is taken at a mean of 55,000 pounds per square inch.

The single-riveted are estimated at .5 the resistance of the plates, and the staggered riveted at .65.

Such allowances for the resistance and wear of the plates, oxydation, etc., are to be made, as the character of the metal, the nature of the services, and the circumstance of using fresh or salt water, etc., will render necessary.

In riveted plates, it is customary in practice to estimate the safe tensile resistance of the metal of a boiler or tube, when exposed to salt-water, at one-fifth of its ultimate resistance or bursting pressure; and, when exposed to fresh-water alone, at one-fourth of it.

Hosted by Google

TRENTON VISE and TOOL WORKS,

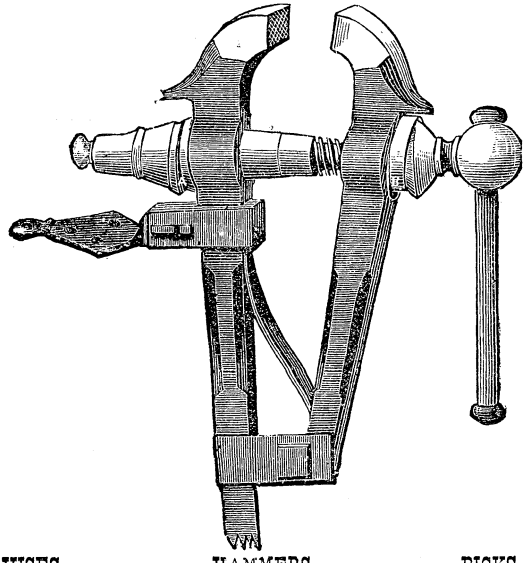
TRENTON, N. J.

HERMANN BOKER & CO.,

PROPRIETORS.

Office and Warehouse, 101 & 103 Duane Street, and 91 & 93 Thomas Street,

NEW YORK.



VISES.

Swivel Vises.
Plain Parallel.
Coachmakers.
Solid Box.
Pipe.
Vise Screws.

Stone Sledges.
Smith Sledges.
Coal Sledges.

HAMMERS.

Striking.
Napping.
Hand Drilling.
Blacksmiths.
Mason.
Stone.
Engineers.
Chipping.
Riveting.
Ball Pene.

PICKS.

Railroad,
Mill.
Stone.
Clay.
Coal,

Railroad Mauls.
Ship Mauls.
Mattocks.

Chisels, Tongs, Bench Screws, Wedges, Crowbars, &c.

☞ *SEND FOR ILLUSTRATED PRICE LIST.*

Hosted by Google

Lock Nuts.

Jno. W. Quincy.....New York.....See Page 178
Lock Nut & Bolt Co. of New York..... " " ..... " 272
Vose, Dinsmore & Co..... " " ..... " 60

Locks.

L. G. Tillotson & Co.....New York.....See Page 94
Pratt & Co.....Buffalo, N. Y..... " 132
Radley & McAlister Manufacturing Co.....New York..... " 250
Ritchie & Son.....Newark, N. J..... " 44
Romer & Co..... " ..... " 204
Vose, Dinsmore & Co.....New York..... " 60

Locomotive Balances.

Tyng & Co.....New York.....See Page 260

Locomotive Bells.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116

Locomotive Blocks.

Hall & Sons.....Buffalo, N. Y.....See Page 254
Maurer & Weber.....New York..... " 228
Philip Neukumet.....Philadelphia, Pa..... " 104
Star Fire Brick Co.....Pittsburgh, Pa..... " 232

Locomotive Builders.

Baldwin Locomotive Works.....Philadelphia, Pa.....See Page 78
Porter, Bell & Co.....Pittsburgh, Pa..... " 128
Schenectady Locomotive Works.....Schenectady, N. Y..... " 148

Locomotive Head Lights.

Buffalo Steam Gauge Co.....Buffalo, N. Y.....See Page 170
Radley & McAlister Manufacturing Co.....New York..... " 250
Vose Dinsmore & Co..... " " ..... " 60

WROUGHT IRON FLUES.

Resistance to Collapsing Pressure.

(From Haswell.)

Diameter. Ins.	Length. Feet.	Thickness. Ins.	Collapsing Pressure per Square Inch. Lbs.	Diameter. Ins.	Length. Feet.	Thickness. Ins.	Collapsing Pressure per Square Inch. Lbs.
6	10	.2	417	11½	12	.2	197
6½	10	.2	385	11½	12	¼	308
7	10	.2	357	11½	12	5/16	532
7	10	¼	580	12	15	.2	153
7½	10	.2	333	12	15	¼	239
7½	10	¼	542	12	15	5/16	415
8	10	.2	312	12½	15	¼	229
8	10	¼	508	12½	15	5/16	398
8½	10	.2	294	13	15	¼	220
8½	10	¼	478	13	15	5/16	384
9	10	.2	278	13½	15	¼	212
9	10	¼	451	13½	15	5/16	369
9½	10	.2	263	14	18	¼	176
9½	10	¼	427	14	18	5/16	305
10	12	.2	227	14½	18	¼	168
10	12	¼	354	14½	18	5/16	294
10	12	5/16	612	15	20	¼	157
10½	12	.2	216	15	20	5/16	276
10½	12	¼	337	15½	20	¼	152
10½	12	5/16	583	15½	20	5/16	267
11	12	.2	2: 6	16	20	¼	148
11	12	¼	322	16	20	5/16	231
11	12	5/16	557				

See notes at foot of table about "Shells of Boilers," page 153.

Hosted by Google

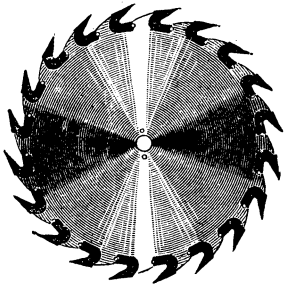
AMERICAN SAW COMPANY,

No. 1 FERRY STREET,

COR. OF GOLD

NEW YORK.

Patent Movable-Toothed Circular Saws,



PATENT PERFORATED

CIRCULAR SAWS, MILL, MULAY

AND

CROSS-CUT SAWS.

SEND FOR PAMPHLET.

Hosted by Google

Locomotives.

Baldwin Locomotive Works.....Philadelphia, Pa.....See Page 78
Greene & Randolph.....New York..... " 54
H. N. Winans—(Boiler Powders)..... " " ..... " 108
Miller & Smith..... " " ..... " 112
O. W. Child ..... " " ..... " 262
Porter, Bell & Co.....Pittsburgh, Pa..... " 128
Schenectady Locomotive Works.....Schenectady, N. Y..... " 148
Wiard Locomotive Attachment Co.—(Anti-Explosive).....New York.....See Page 110

Log Sawing Machine.

J. T. & R. H. Plass.....New York.....See Page 208

Looking Glasses.

Leffingwell & Co..... .....Cleveland, Ohio..... .....See Page 190
See also, Glass—Looking.

Lubricating Oils.

Eclipse Lubric Oil Co.....New York.....See Page facing Title
Frazer Lubricator Co..... " " .....See Page 264
F. S. Pease.....Buffalo, N. Y..... " 100
Isaac U. Coles.....New York..... " 20
P. H. Moffat.....Chicago, Ill..... " 190
Posts & Kalkman.....New York..... " 266
Wm. B. Browne & Co..... " " ..... " 266

BOARD MEASURE—4 PAGES.

Table gives Feet of Board Measure to One Running Foot of Board.

Area of a running foot multiplied by length in feet, will give superficial contents of board in square feet.

Application of Table:

A board is 1 inch thick, 1 foot 4¾ inches wide by 21 feet long. What is its contents? *Answer*, 1 foot equal 1, and 4¾ in. equal .3958, therefore, 1 foot 4¾ in. equal 1.3958, multiplied by 21, equal 29.3 feet, which is contents of board.

Thick. Inch.	Width of Board in Inches.								
	½	¾	1	1¼	1½	1¾	2	2¼	½
¼	.0104	.0156	.0208	.026	.0313	.0365	.0417	.0469	.0521
½	.0209	.0313	.0417	.0521	.0625	.0729	.0833	.0938	1.42
¾	.0313	.0469	.0625	.0781	.0938	.1094	.125	.1406	.1563
1	.0417	.0625	.0833	.1042	.125	.1458	.1667	.1875	.2083
¼	.0521	.0781	.1042	.1302	.1563	.1823	.2083	.2344	.2604
½	.0625	.0938	.125	.1563	.1875	.2188	.25	.2813	.3125
¾	.0729	.1094	.1458	.1823	.2187	.2552	.2917	.3281	.3646
2	.0833	.125	.1667	.2083	.25	.2917	.3333	.375	.4166
¼	.0938	.1406	.1875	.2344	.2813	.3281	.375	.4219	.4688
½	.1042	.1563	.2083	.2604	.3125	.3646	.4167	.4688	.5208
¾	.1146	.1719	.2292	.2865	.3438	.401	.4583	.5156	.573
3	.125	.1875	.25	.3125	.375	.4375	.5	.5625	.625
¼	.1355	.2032	.2708	.3385	.4063	.4739	.5416	.6094	.677
½	.1457	.2186	.2917	.3646	.4375	.5104	.5833	.6563	.7292
¾	.1563	.2345	.3125	.3906	.4689	.5469	.625	.7031	.7813
4	.1666	.25	.3333	.4167	.5	.5833	.6667	.75	.8333
¼	.177	.2655	.3542	.4427	.5312	6198	.7083	.797	.8854
½	.1875	.2813	.375	.4688	.5625	.6563	.75	.8438	.9375
¾	.198	.297	.3958	.4948	.5938	.6927	.7917	.8905	.9895
5	.2083	.3125	.4167	.5208	.625	.7292	.8333	.9375	1.004
¼	.2187	.3231	.4375	.547	.6562	.7655	.875	.9845	1.095
½	.2291	.3437	.4583	.5729	.6875	.802	.9166	1.03	1.145
¾	.2395	.3594	.4791	.599	.7187	.8385	.9583	1.077	1.198
6	.25	.375	.5	.625	.75	.875	1.	1.125	1.25

Hosted by Google

ESTABLISHED 1847.

LUCIUS W. POND,

MANUFACTURER OF

MACHINISTS' TOOLS,

Works, Corner of Union & Exchange Sts., WORCESTER, Mass.

WM. B. HOWE, Sup't.
GARDNER LIGHT, M.M.

Warerooms, 98 Liberty St., N. Y.
A. C. STEBBINS, Agt.

ALSO, SOLE MANUFACTURER OF

Taft's Celebrated Hand Punches and Shears, for Metals.

Lehicton Paint and Linseed Oil Mills.

C. E. HECHT, ESTABLISHED 1857. **EASTON, PENN'A.**

MANUFACTURER OF

LINSEED OIL, LEADS, ZINCS AND COLORS.

"CAR COLORS"

FOR FREIGHT, COAL AND PASSENGER CARS,

A SPECIALTY.

☞Send me a sample of what you want, and I will give you a price.☜

I DEFY COMPETITION.

FRANK M. ALFORD,

AVON, CONN.,

MANUFACTURER OF

Best Quality Cotton, Hemp and Water-Proof

SAFETY FUSE.

WARRANTED SURE TO IGNITE THE CHARGE.

Hosted by Google

Lubricators.

A. Carr.....New York.....See Page 244
Crane Bros. Manufacturing Co.....Chicago, Ill..... " 230
Frazer Lubricator Co.....New York..... " 264
Isaac U. Coles..... " " ..... " 20
J. G. Knapp Manufacturing Co..... " " ..... " 16
McNab & Harlin Manufacturing Co..... " " ..... " 220
Pancoast & Maule.....Philadelphia, Pa..... " 26
Posts & Kalkman.....New York..... " 266
Wiard Locomotive Attachment Co..... " " ..... " 110

Lumber.

Joseph Churchyard.....Buffalo, N. Y.....See Page 160

Machine Bits.

Champlin & Rogers.....Chicago, Ill.....See Page 192

Machine Bolts.

Wm. H. Haskell & Co; H. B. Newhall, Agent..New York.....See Page 166
Providence Tool Co.; " " ..... " 166

Machine Forgings.

Pittsburgh Forge & Iron Co.....Pittsburgh, Pa.....See Page 174

Machine Oils.

Isaac U. Coles.....New York.....See Page 20
Wm. B. Browne & Co..... " " ..... " 266
See also, Lubricating Oils, Oils, &c., &c.

Machine or Nut Taps.

R. L. Howard & Son.....Buffalo, N. Y.....See Page 40
The Worcester Machine Screw Co.; H. B. Newhall, Agent.....New York.....See Page 166
See also, Taps; Nut Tappers, &c.

BOARD MEASURE—CONTINUED.

Feet of Board Measure to One Running Foot of Board

(See application at head of table.)

Width of Board in Inches.

Thick. Inch.	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾
¼	.0573	.0625	.0678	.073	.078	.0833	.0885	.0937	.099
½	.1145	.125	.1355	.1457	.1562	.1668	.177	.1875	.198
¾	.172	.1875	.203	.2188	.2344	.25	.2656	.3813	.297
1	.2292	.25	.2708	.2917	.3125	.3334	.3542	.375	.3958
¼	.2865	.3125	.3385	.3645	.3906	.4167	.4426	.4687	.4948
½	.3438	.375	.4062	.4375	.4687	.5	.5314	.5625	.5938
¾	.401	.4375	.474	.5105	.5470	.5834	.6198	.6563	.6927
2	.4583	.5	.5417	.5834	.625	.6667	.7084	.75	.7917
¼	.5155	.5625	.6095	.6563	.703	.75	.797	.8437	.8905
½	.573	.625	.677	.7292	.7814	.8334	.8855	.9375	.9895
¾	.6302	.6875	.7448	.802	.8595	.9167	.974	1.03	1.09
3	.6875	.75	.8125	.875	.9375	1.	1.063	1.125	1.188
¼	.7448	.8125	.8802	.948	1.016	1.083	1.15	1.22	1.286
½	.802	.875	.948	1.021	1.095	1.168	1.24	1.314	1.386
¾	.8595	.9375	1.015	1.095	1.172	1.25	1.327	1.406	1.485
4	.9167	1.	1.802	1.168	1.25	1.333	1.415	1.5	1.583
¼	.974	1.062	1.15	1.24	1.328	1.418	1.505	1.595	1.682
½	1.03	1.125	1 22	1.313	1.405	1.5	1.593	1.689	1.782
¾	1.086	1.187	1.285	1.385	1.485	1.584	1.68	1.73	1 88
5	1.146	1.25	1.355	1.457	1.567	1.667	1.77	1.875	1.98
¼	1.203	1.313	1.421	1.53	1.645	1.75	1.858	1.97	2.077
½	1.26	1.375	1.49	1.603	1.722	1.834	1.946	2.063	2.178
¾	1.319	1.438	1.556	1.675	1.8	1.916	2.034	2.155	2.275
6	1.375	1.5	1.625	1.75	1.875	2.	2.125	2.25	2.375

Hosted by Google

Buffalo Machinery Agency.

F. D. CUMMER, PROPRIETOR.

39 MECHANIC STREET, BUFFALO, N. Y.

MANUFACTURER OF

SUPERIOR STATIONARY STEAM ENGINES, BOILERS, &c.

AND DEALER IN

MACHINISTS' TOOLS, WOOD WORKING AND GENERAL CAR MACHINERY, J. B. Hoyt & Co.'s BELTING, BOILER TUBES AND EVERY VARIETY OF SUPPLIES.

Estimates furnished for entire works, including Engine, Boiler, Shafting, Pulleys, Hangers, Belting, Machinery, &c., complete.

Special Prices and Inducements offered to Railroads, Car Works and large Buyers.

JOSEPH CHURCHYARD,

Wood Working Establishment,

Clinton St., (Bet. Adams & Watson,) BUFFALO, N. Y.

Where you may find the following list of Articles:

BLACKSMITHS' AND MOULDERS' BELLOWS

RAILROAD SNOW SHOVELS, SNOW FENCES, SASH, DOORS, MOULDINGS, CISTERNS and TANKS, FLOORING, SIDING, PICKETS, HITCHING POSTS, FARM GATES, BOOK CASES,

LUMBER OF ALL KINDS,

Pine, Hemlock, Cherry, Oak, Black Walnut and Ash, Manufactured or Unmanufactured.

I would be happy to receive your orders, and am confident whatever is entrusted to me will be executed to your satisfaction.

☞ *Price List and Figures sent on application.*

JOSEPH CHURCHYARD.

Hosted by Google

Machines for Emery Wheels.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Machinery.

Buffalo Machinery Agency.....Buffalo, N. Y.....See Page 160
C. Henry Hall & Co.....New York..... " 4
J. B. Waring..... " " ..... " 24
J. S. Mundy.....Newark, N. J..... " 266
L. W. Pond.....Worcester Mass..... " 158
Miller & Smith..... ...New York..... " 112
S. S. Townsend..... " " ..... " 2
Skinner & Gifford Manufacturing Co.....Dunkirk, N. Y..... " 140
Rand & Waring Drill & Compressor Co.....New York.....See Front Page
The Pratt & Whitney Co.....Hartford, Conn.....See Page 142
The Atlas Works.....Pittsburgh, Pa..... " 172
Wiard Locomotive Attachment Co.—(Anti-Explosive).....New York..... " 110
Winans & Co..... " " ..... " 106

Machine Screws.

Providence Tool Co.; H. B. Newhall, Agent.....New York.....See Page 166
The Worcester Machine Screw Co.; H. B. Newhall, Agent..... " " ..... " 166

Machinists.

Bolen, Crane & Co.....Newark, N. J.....See Page 62
Snyder Brothers.....Williamsport, Pa..... " 46

Machinists' Supplies.

Champlin & Rogers.....Chicago, Ill.....See Page 192
Geo. H. Crain & Co..... " " ..... " 124
Pancoast & Maule.....Philadelphia, Pa..... " 26
Posts & Kalkman.....New York..... " 264
Wm. B. Browne & Co..... " " ..... " 266
See also, Machinists' Tools, &c.

BOARD MEASURE—CONTINUED

Feet of Board Measure to One Running Foot of Board.

(See application at head of table.)

Thick. Inch	Width of Board in Inches. 5	5¼	5½	5¾	6	6½	6¾	7	7½
¼	.1042	.1095	.1145	.1198	.125	.1355	.1405	.1458	.1563
½	.20 4	.2189	.2292	.2395	.25	.2708	.2813	.2917	.3125
¾	.3125	.328	.3438	.3597	.375	.4063	.422	.4375	.4687
1	.4166	.4375	.4584	.4792	.5	.5416	.5625	.5834	625
¼	.5208	.547	.573	.5 9	.625	.677	.703	.7292	.7814
½	.625	.6562	.6875	.7187	.75	.8125	.8438	.875	.9375
¾	.7292	.7655	.802	.8385	.875	.948	.9844	1.02	1.095
2	.8334	.875	.9166	.9584	1.	1.0 3	1 125	1.166	1.25
¼	.9375	.9845	1.03	1.077	1.125	1.22	1.266	1.314	1.406
½	1.042	1.095	1.145	1.198	1.25	1.354	1.406	1.459	1.563
¾	1.145	1.203	1 26	1.318	1.375	1.49	1.547	1.604	1 72
3	1.25	1.313	1.375	1.438	1.5	1.625	1.688	1.75	1.875
¼	1.354	1.422	1.49	1.557	1.625	1.76	1.828	1.895	2.03
½	1.458	1.53	1.605	1.678	1.75	1.896	1 97	2.042	2.187
¾	1.564	1.64	1.72	1.797	1.875	2.031	2.109	2.187	2.345
4	1.668	1.75	1.834	1.917	2.	2.167	2.25	2.334	2.5
¼	1.77	1.857	1.918	2.335	2.125	2.202	2.39	2.48	2.655
½	1.875	1 97	2.063	2.155	2.250	2.438	2.53	2.625	2.813
¾	1 98	2.079	2.176	2.275	2.375	2 573	2.672	2.77	2 7
5	2.084	2.187	2.292	2.395	2.5	2.708	2.813	2.917	3.125
¼	2.187	2 297	2.405	2 515	2 625	2.845	2.954	3.063	3.28
½	2.2 3	2.406	2 52	2.634	2.750	2.98	3.095	3.209	3 437
¾	2.397	2.516	2.635	2.755	2.875	3.116	3.234	3.355	3.595
6	2.5	2.625	2.75	2.875	3.	3.25	3.375	3.5	3.75

Hosted by Google

England & Bindley,

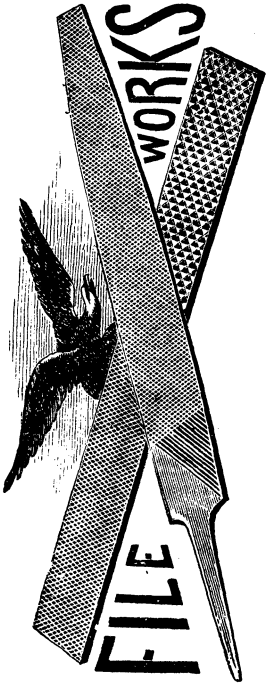
HARDWARE, CUTLERY,

CONTRACTORS' TOOLS,

MANUFACTURERS OF

Superior Hand-Cut

FILES AND RASPS.



Special Attention Paid to Re-cutting

AND

WARRANTED SUPERIOR TO ANY IN THE COUNTRY.

☞ SEND FOR PRICES. ☜

PICKS, SHOVELS, &C.

263 Liberty Street,

PITTSBURGH, PA.

Hosted by Google

Machinists' Tools.

Bolen, Crane & Co.....Newark, N. J.....See Page 62
Buffalo Machinery Agency.....Buffalo, N. Y..... " 160
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Isaac H. Shearman.....Philadelphia, Pa..... " 80
L. W. Pond.....Worcester, Mass..... " 158
Nelson Tool Works.....New York..... " 30
The Pratt & Whitney Co.....Hartford, Conn..... " 142
Thorne, De Haven & Co.....Philadelphia, Pa..... " 38
Wm. B. Bement & Son..... " " ..... " 168
Wm. Sellers & Co..... " " ..... " 64

Malleable Iron Castings and Fittings.

Crane Bros. Manufacturing Co.....Chicago, Ill.....See Page 230
Phelps & Sanger.....Cleveland, Ohio..... " 120

Manufacturers Agents.

Winans & Co.....New York.....See Page 106

Marine Forgings.

De Laney & Co.....Buffalo, N. Y.....See Page 98

Marking Cards.

W. W. Wilcox.....Chicago, Ill.....See Page 190

Masons' Tools.

England & Bindley.....Pittsburgh, Pa.....See Page 162

Mathematical Instruments.

F. Eckel.....New York.....See Page 76
F. S. Pease.....Buffalo, N. Y..... " 100
Kuebler & Seelhorst.....Philadelphia, Pa..... " 216
Wm. J. Young & Sons..... " " ..... " 138

Mattocks.

Hermann Boker & Co.....New York.....See Pages 152, 154

Mauls.

Hermann Boker & Co.....New York.....See Pages 152, 154
Nelson Tool Works..... " " .....See Page 30

BOARD MEASURE—Continued.

Feet of Board Measure to One Running Foot of Board.

(See application at head of table.)

Thick. Inch.	Width of Board in Inches. 8	8½	9	9½	10	10½	11	11½	12
¼	.1666	.1771	.1875	.198	.2083	.2187	.2292	.2395	.25
½	.3334	.3542	.375	.3958	.4167	.4375	.4583	.4792	.5
¾	.5	.5312	.5625	.5938	.625	.6562	.6875	.7187	.75
1	.6667	.7084	.75	.7916	.8334	.875	.9167	.9584	1.
¼	.8334	.8855	.9375	.9896	1.042	1.094	1.146	1.198	1.25
½	1.	1.062	1.125	1.187	1.25	1.312	1.375	1.437	1.5
¾	1.166	1.24	1.312	1.385	1.458	1.531	1.605	1.677	1.75
2	1.333	1.417	1.5	1.583	1.667	1.75	1.833	1.917	2.
¼	1.5	1.595	1.687	1.78	1.875	1.963	2.062	2.155	2.25
½	1.667	1.77	1.875	1.98	2.083	2.187	2.292	2.395	2.5
¾	1.834	1.948	2.063	2.177	2.292	2.406	2.521	2.635	2.75
3	2.	2.125	2.25	2.375	2.5	2.625	2.75	2.875	3.
¼	2.167	2.302	2.437	2.573	2.708	2.845	2.98	3.115	3.25
½	2.334	2.48	2.625	2.77	2.917	3.063	3.208	3.354	3.5
¾	2.5	2.655	2.812	2.97	3.125	3.28	3.437	3.594	3.75
4	2.667	2.834	3.	3.167	3.334	3.5	3.667	3.833	4.
¼	2.833	3.01	3.188	3.365	3.542	3.719	3.896	4.073	4.25
½	3.	3.187	3.375	3.562	3.75	3.938	4.125	4.313	4.50
¾	3.166	3.366	3.563	3.76	3.958	4.155	4.354	4.552	4.75
5	3.334	3.542	3.75	3.958	4.16	4.375	4.583	4.79	5.
¼	3.5	3.72	3.937	4.155	4.375	4.595	4.813	5.032	5.25
½	3.666	3.896	4.125	4.353	4.584	4.812	5.041	5.27	5.5
¾	3.834	4.072	4.313	4.553	4.793	5.03	5.271	5.51	5.75
6	4.	4.25	4.5	4.75	5.	5.25	5.5	5.75	6.

Hosted by Google

GEO. H. BLISS & CO.,

41 Third Avenue, Chicago, Ill.,

MANUFACTURERS AND DEALERS IN

TELEGRAPH INSTRUMENTS AND SUPPLIES,

AND

ELECTRICAL APPARATUS.

Instruments,
Instrument Fixtures,
Batteries and Utensils,
Chemicals,
Galvanometers,
Line Material,
Repairers' Tools,
Cables and Gutta Percha Wire,
Magnet Wire,
Office Wire,
Office Fixtures,
Telegraph Poles,
Medical Apparatus,
Electric Bells.

HOTEL ANNUNCIATORS.

FIRE AND BURGLAR ALARMS.

SEND FOR A CATALOGUE.

Hosted by Google

Measuring Tapes.

F. Eckel.....New York..... .....See Page 76

Mechanics' Tools.

Newcomb Bro's Sons..... .....New York .....See Page 88

Medical Apparatus—Electrical and Gutta Percha.

Bishop Gutta Percha Works .....New York .....See Page 34
Charles T. Chester..... " " ..... " 212
Leclanche Battery Co..... " " ..... " 96

TO FIND SOLIDITY OF ROUND TIMBER.

When all the dimensions are in feet.
Length multiplied by square of ¼ mean girth equal cubic feet.
When length in feet, girth in inches.
Multiply as above, and divide by 144.
When all dimensions are in inches
Multiply as above, and divide by 1728.

TO FIND SOLIDITY OF SQUARE TIMBER.

When all dimensions are in feet.
Length multiplied by breadth multiplied by depth, equal cubic feet.
When either dimensions are in inches.
Multiply as above, and divide by 12.
When any two of the dimensions are in inches.
Multiply as above, and divide by 144.
Or use the following table as shown at foot of same.

TABLE ¼ GIRTHS.

¼ Girth. in inches.	Area in Feet.	¼ Girth in Inches.	Area in Feet.	¼ Girth in Inches	Area in Feet.
6	.250	12¼	1.04	19	2.50
¼	.272	½	1.08	½	2.64
½	.294	¾	1.12	20	2.77
¾	.317	13	1.17	½	2.91
7	.340	¼	1.20	21	3.06
¼	.364	½	1.26	½	3.20
½	.390	¾	1.31	22	3.36
¾	.417	14	1.36	½	3.51
8	.444	¼	1.41	23	3.67
¼	.472	½	1.46	½	3.83
½	.501	¾	1.51	24	4.00
¾	.531	15	1.56	½	4.16
9	.562	¼	1.61	25	4.34
¼	.594	½	1.66	½	4.51
½	.626	¾	1.72	26	4.69
¾	.659	16	1.77	½	4.87
10	.694	¼	1.83	27	5.06
¼	.730	½	1.89	½	5.25
½	.766	¾	1.94	28	5.44
¾	.803	17	2.0	½	5.64
11	.840	¼	2.06	29	5.84
¼	.878	½	2.12	½	6.04
½	.918	¾	2.18	30	6.25
¾	.959	18	2.25		
12	1.000	½	2.37		

Area corresponding to the ¼ girth in inches multiplied by length in feet gives solidity in feet and decimal parts for either square or round timber.

In Round Timber take the *mean* girth. Square Timber take the side, which in practice corresponds with ¼ of the girth of Round Timber.

Hosted by Google

PROVIDENCE TOOL COMPANY.
RHODE ISLAND NUT COMPANY.
WILLIAM H. HASKELL & CO.

LEWIS OLIVER & PHILLIPS.
THE READING BOLT & NUT WORKS.
WORCESTER MACHINE SCREW CO.

MANUFACTURERS OF

HEAVY HARDWARE, RAIL ROAD SUPPLIES,
MARINE HARDWARE and SHIP CHANDLERY.

E. B. NEWHALL, Agent.

11 WARREN STREET, - - NEW YORK.

Hosted by Google

Merchant Iron.

Jno. A. Griswold & Co	Troy, N. Y	See Page 50
Jones & Laughlins	Pittsburg, Pa	" 32
Pittsburgh Bolt Co	"	" 118
Pittsburgh Forge & Iron Co	"	" 174
Pratt & Co	Buffalo, N. Y	" 132
Reese, Graff & Woods	Pittsburg, Pa	" 68
Rogers & Co	Chicago, Ill	" 144

Metal Blanks.

Mathiesen & Schrader	New York	See Page 82
W. W. Wilcox	Chicago, Ill	" 190

Metal Cornices.

Hart, Ball & Hart	Buffalo, N. Y	See Page 136
Noyes & Wines	New York	" 264

Metallic Packing.

A. Fulton's Son & Co	Pittsburgh, Pa	See Page 116

Metallic Paints.

Vose, Dinsmore & Co	New York	See Page 60
Jno. W. Masury & Son	"	" 214
Prince's Metallic Paint Co	"	" 236

Metallurgists.

DuPlaine & Reeves	Philadelphia	See Page 102

Metals, Domestic and Imported.

Du Plaine & Reeves	Philadelphia, Pa	See Page 102
Tyng & Co	New York	" 260

WHEEL GEARING.—4 PAGES.

TERMS OR NAMES. (*Haswell.*)

The *Pitch Line* of a wheel, is the circle upon which the pitch is measured, and it is the circumference by which the diameter, or the velocity of the wheel, is measured.

The *Pitch* is the arc of the circle of the pitch line, and is determined by the number of the teeth in the wheel.

The *True Pitch (Chordial)*, or that by which the dimensions of the tooth of a wheel are alone determined, is a straight line drawn from the centres of two contiguous teeth upon the pitch line.

The *Line of Centres* is the line between the centres of two wheels.

The *Radius* of a wheel is the semi-diameter running to the periphery of a tooth.

The *Pitch Radius* is the semi-diameter running to the pitch line.

A *Mortice Wheel*, is a wheel constructed for the reception of teeth or cogs, which are fitted into recesses or sockets upon the face of the wheel

A wheel which impels another is termed the *Spur*, *Driver* or *Leader;* the one impelled is the *Pinion*, *Driven* or *Follower*.

A series of wheels in connection with each other is termed a *Train*.

When two wheels act upon one another, the greater is termed the *Wheel*, and the lesser the *Pinion*.

When a *Pinion is driven by a wheel*, the number of teeth in the pinion should not be less than eight.

When a *Wheel is driven by a pinion*, the number of teeth in a pinion should not be less than ten.

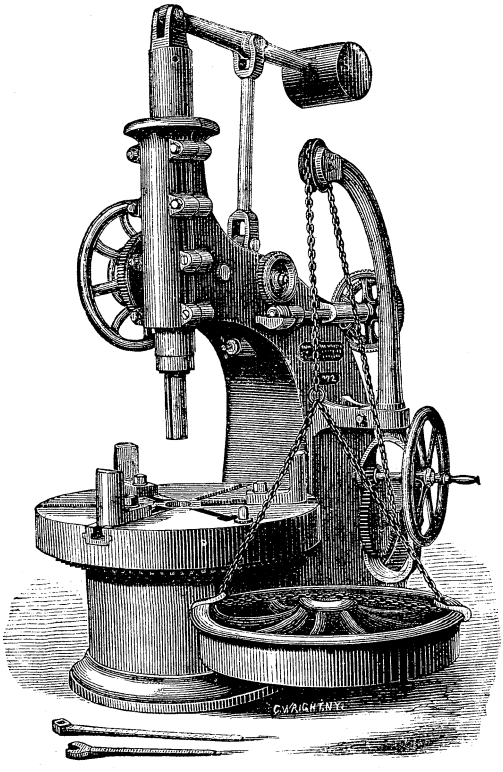
The *Number of teeth* in the wheel should not be divisible by the number of teeth in the pinion without a remainder This is in order to prevent the same teeth coming together so often as to cause an irregular wear of their faces.

PROPORTION OF TEETH OF WHEELS. (*Molesworth.*)

From pitch line to top of tooth	= Pitch × 0.33
Total depth of teeth	= Pitch × 0.75
Thickness of tooth on pitch line	= Pitch × 0.45
Space between teeth on pitch line	= Pitch × 0.55
Thickness of rim of wheel	= Pitch × 0.45
Thickness of arms if flat	= Pitch × 0.45
Ordinary width of teeth in small pitches	= Pitch × 2.
" " " large "	= Pitch × 3.
Thickness round centre	= Pitch × 1.3

Mortice wheels to be wider than iron wheels by twice the thickness of the rim or by pitch × 0.9; their rim to be double the thickness of that of iron wheels.

Hosted by Google



MACHINISTS' TOOLS.

WM. B. BEMENT & SON,

INDUSTRIAL WORKS, - - Philadelphia.

Machine Shop, Foundry, Smith Shop and Boiler Shop Equipments.

Railroad Shop Machinery

OF EVERY DESCRIPTION.

STEAM HAMMERS,

OF ALL SIZES.

Hosted by Google

Milling Machines.

Isaac H. Shearman.....Philadelphia, Pa.....See Page 80
Phelps & Sanger.....Cleveland, O..... " 120
Wm. Sellers & Co.....Philadelphia, Pa..... " 64

Mineral Door Knobs.

Romer & Co.....Newark, N. J.....See Page 204

Mining Engines.

J. S. Mundy.....Newark, N. J.....See Page 266

Mining Locomotives.

Porter, Bell & Co.....Pittsburgh, Pa.....See Page 128

Mining Machinery.

C. Henry Hall & Co.....New York.....See Page 4
J. B. Waring..... " ..... " 24
Rand & Waring Drill & Compressor Co..... " .....See Front Page
The Atlas Works.....Pittsburgh, Pa .....See Page 172
Winans & Co.....New York..... " 106

Mining Tools.

Nelson Tool Works.....New York .....See Page 30

Models.

Mathiesen & Schrader.....New York.....See Page 82
Towle & Unger Manufacturing Co..... " ..... " 186

Mortising Machines.

England & Bindley.....Pittsburgh, Pa.....See Page 162
J. A. Fay & Co.....Cincinnati, Ohio..... " 206
Richards, London & Kelley.....Philadelphia, Pa..... " 66
Wm. P. Kellogg & Co.....Troy, N. Y..... " 98
See also, Iron Working Machinery—Wood Working Machinery.

Moulders' Tools.

Van Tuyl Manufacturing Co.....New York.....See Page 242

Moulding Cutters.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Muck Bars.

Chas. W. Matthews.....Philadelphia, Pa.....See Page 38

WHEEL GEARING—CONTINUED.

(*Haswell.*)

To compute the Number of Teeth in a Pinion or Follower to have a given Velocity.

RULE.—Multiply the velocity of the driver by its number of teeth, and divide the product by the velocity of the driven.

Example.—The velocity of a driver is 16 revolutions, the number of its teeth 54, and the velocity of the pinion is 48; what is the number of its teeth?

$$16 \times 54 \div 48 = 18 \textit{ teeth.}$$

2. A wheel having 75 teeth is making 16 revolutions per minute; what is the number of teeth required in the pinion to make 24 revolutions in the same time?

$$16 \times 75 \div 24 = 50 \textit{ teeth.}$$

To Compute the Diameter of a Wheel for a given Pitch and Number of Teeth.

RULE.—Multiply the diameter in the following table for the number of teeth by the pitch, and the product will give the diameter at the pitch circle.

Example.—What is the diameter of a wheel to contain 48 teeth of 2.5 ins. pitch?

$$15.29 \times 2.5 = 38.225 \textit{ ins.}$$

To Compute the Pitch of a Wheel for a given Diameter and number of Teeth.

RULE.—Divide the diameter of the wheel by the diameter in the table (page 171) for the number of teeth, and the product will give the pitch.

Example.—What is the pitch of a wheel when the diameter of it is 50.94 inches, and the number of its teeth 80?

$$50.94 \div 25.47 = 2 \textit{ ins.}$$

To Compute the Number of Teeth of a Wheel for a given Diameter and Pitch.

RULE.—Divide the diameter by the pitch, and opposite to the quotient in the table (page 171) is given the number of teeth.

Hosted by Google

T. S. RAY. *C. A. MARVIN.*

BUFFALO STEAM GAUGE COMPANY,

MANUFACTURERS OF

BUFFALO PRESSURE AND VACUUM GAUGES

LOCOMOTIVE HEAD LIGHTS,

LAMPS and SIGNALS.

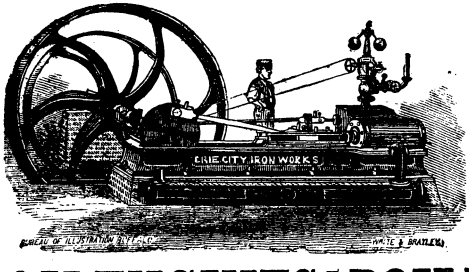
Cor. Washington & Perry Streets,

BUFFALO, NEW YORK.

ERIE CITY IRON WORKS,

ERIE, PENN'A,

MANUFACTURERS OF



STEAM ENGINES and BOILERS

Circular Saw Mills, Eureka Head Blocks, Shafting and Pulleys,

AND DEALERS IN

Steam Pumps, Circular Saws, Belting, &c.

Hosted by Google

Nail Rods.

England & Bindley.....Pittsburgh, Pa.....See Page 162

Nails—Cut.

Collier & Scranton; Oxford Iron Co.....New York.....See Page 122
England & Bindley..... Pittsburg, Pa..... " 162
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Jones & Laughlins..... .....Pittsburg, Pa..... " 32
John W. Quincy.....New York .... " 178
Pratt & Co.....Buffalo, N. Y..... " 132
Sidney Shepard & Co..... " ..... " 196
Wm. Green & Co..... .....Wilmington, Del..... " 248
See also, Nails—Wrought.

Nails—Wrought.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246
Jno. W. Quincy.....New York..... " 178
Pratt & Co.....Buffalo, N. Y..... " 132
Wm. Green & Co .....Wilmington, Del..... " 248
See also, Nails—Cut.

WHEEL GEARING—CONTINUED.

PITCH OF WHEELS. (*Haswell.*)

Showing the Diameter of a Wheel for a given Pitch, or the Pitch for a given Diameter.

No. of Teeth.	Diameter. Inches.	No. of Teeth.	Diameter. Inches.	No. of Teeth.	Diameter. Inches.	No. of Teeth.	Diameter. Inches.
8	2.61	45	14 33	82	26.11	119	37.88
9	2.93	46	14.65	83	26.43	120	38.2
10	3.24	47	14.97	84	26.74	21	38.52
11	3.55	48	15.29	85	27.06	122	38.84
12	3.86	49	15.61	86	27.38	123	39.16
13	4.18	50	15.93	87	27.7	124	39.47
14	4.49	51	16.24	88	28.03	125	39.79
15	4.81	52	16.56	89	28.33	126	40.11
16	5.12	53	16.88	90	28.65	127	40.43
17	5.44	54	17.2	91	28.97	128	40.75
18	5.76	55	17.52	92	29 29	129	41.07
19	6.07	56	17.8	93	29.61	130	41.38
20	6.39	57	18.15	94	29.93	131	41.7
21	6.71	58	18.47	95	30.24	132	42.02
22	7.03	59	18.79	96	30.56	133	42.35
23	7.34	60	19.11	97	30.88	134	42.66
24	7.66	61	19 42	98	31.2	135	42.98
25	7.98	62	19.74	99	31.52	136	43.29
26	8.3	63	20.06	100	31.84	137	43,61
27	8.61	64	20.38	101	32.15	138	43.93
28	8.93	65	20.7	102	32.47	139	44.25
29	9.25	66	21.02	103	32.79	140	44.57
30	9.57	67	21.33	104	33.11	141	44.88
31	9.88	68	21.65	105	33.43	142	45.2
32	10.2	69	21.97	106	33.74	143	45.52
33	10.52	70	22.29	107	34.06	144	45.84
34	10.84	71	22.61	108	34.38	145	46.16
35	11.16	72	22.92	109	34.7	146	46.48
36	11.47	73	23.24	110	35.02	147	46.79
37	11.79	74	23.56	111	35.34	148	47.11
38	12.11	75	23.88	112	35.65	149	47.43
39	12.43	76	24.2	113	35.97	150	47.75
40	12.74	77	24.52	114	36.29	151	48 07
41	13.06	78	24.83	115	36.61	152	48.39
42	13.38	79	25.15	116	36.93	153	48.7
43	13.7	80	25.47	117	37.25	154	49.02
44	14.02	81	25.79	118	37.56	155	49.35

NOTE. The pitch in this table is the *true pitch*, as before described.

Hosted by Google

THE ATLAS WORKS CO.

THOMAS N. MILLER, President.

28th STREET, PITTSBURG, PA.

FOUNDRY SPECIALTIES ARE

LOCOMOTIVE ENGINE CYLINDERS,

HAMMER DIES AND ANVIL BLOCKS.

Railways Equipped

WITH

FROGS, CROSSINGS,

SWITCHES, and

BRIDGE CASTINGS.

COKING, COAL WASHING,

AND

GOLD AND SILVER MINING

MACHINERY.

Hosted by Google

Nickle.

Lucius Hart & Co.....New York.....See Page 56

Nuts, &c.

Collier & Scranton; Oxford Iron Co.....New York.....See Page 122
G. B. Walbridge..... " " ..... " 130
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Greene & Randolph.....New York..... " 54
Hoopes & Townsend.....Philadelphia, Pa..... " 28
Lewis Oliver & Phillips, H. B. Newhall, Agent, New York..... " 166
Miller & Smith..... " " ..... " 112
New Haven Nut Co.....New Haven, Conn..... " 142
Lock, Nut & Bolt Co. of New York.....New York..... " 272
O. W. Child..... " " ..... " 262
Phillipsburg Manufacturing Co..... " " ..... " 22
Pittsburgh Bolt Co.....Pittsburgh, Pa..... " 118
Pratt & Co.....Buffalo, N. Y..... " 132
Providence Tool Co., H. B. Newhall, Agent.....New York..... " 166
Reading Bolt & Nut Works, H. B. Newhall, Agent..... " " ..... " 166
Rhode Island Nut Co., H. B. Newhall, Agent....New York.....See Page 166
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138
Vose, Dinsmore & Co.....New York..... " 60
Wm. Gilmor of Wm.....Baltimore, Md..... " 248
Wm. H. Haskell & Co., H. B. Newhall, Agent...New York..... " 166
Wm. Green & Co.....Wilmington, Del..... " 248

WHEEL GEARING—CONTINUED.

TEETH OF WHEELS—CAST-IRON. (*Molesworth.*)

Table showing the Horse-Power that may be transmitted by each Inch of Breadth of Tooth, with different Velocities and Pitches.

Veloc. in ft. per sec.	Pitch of Teeth in Inches.										
	¾	1	1¼	1½	1¾	2	2½	3	4	5	6
	h.p.	h.p.	h.p.	h.p.	h.p.	h.p.	h.p.	h.p.	h.p.	h.p.	h.p.
¼	.008	.015	.023	.033	.045	.06	.093	.135	.24	.37	.54
½	.017	.03	.047	.67	.09	.12	.18	.27	.43	.75	.108
¾	.025	.045	.07	.101	.138	.18	.281	.4	.72	1.12	1.62
1	.033	.06	.094	.135	.184	.24	.375	.54	.96	1.5	2.16
2	.067	.12	.188	.27	.366	.48	.75	1.08	1.9	3.0	4.3
3	.10	.18	.28	.40	.55	.72	1.1	1.6	2.8	4.5	6.4
4	.13	.24	.37	.54	.73	.96	1.5	2.1	3.8	6.	8.6
5	.17	.30	.47	.67	.91	1.2	1.8	2.7	4.8	7.5	10.8
6	.20	.36	.56	.81	1.1	1.4	2.2	3.2	5.7	9.	12.9
7	.23	.42	.65	.94	1.28	1.68	2.6	3.7	6.7	10.5	15.1
8	.27	.48	.75	1.1	1.4	1.9	3.	4.3	7.6	12.	17.2
9	.30	.54	.84	1.2	1.6	2.1	3.3	4.8	8.6	13.5	19.4
10	.33	.6	.94	1.35	1.8	2.4	3.7	5.4	9.6	15.	21.6
12	.40	.72	1.1	1.6	2.1	2.8	4.5	6.4	11.5	18.	25.9
14	.47	.84	1.3	1.8	2.5	3.3	5.2	7.5	13.4	21.	30.2
16	.54	.96	1.5	2.1	2.9	3.8	6.	8.6	15.3	24.	34.5
18	.61	1.1	1.7	2.4	3.3	4.3	6.7	9.7	17.3	27.	38.9
20	.66	1.2	1.9	2.7	3.6	4.8	7.5	10.8	19.2	30.	43.2
22	.74	1.3	2.1	2.9	4.	5.3	8.2	11.9	21.1	33.	47.5
24	.81	1.4	2.2	3.2	4.4	5.7	9.	12.9	23.	36.	51.8
26	.88	1.5	2.4	3.5	4.7	6.2	9.7	14.	24.9	39.	56.1
28	.95	1.6	2.6	3.7	5.1	6.7	10.5	15.1	26.9	42.	60.4
30	1.01	1.8	2.8	4.	5.5	7.2	11.2	16.2	28.8	45.	64.8
35	1.2	2.1	3.3	4.7	6.4	8.4	13.1	18.9	33.6	52.5	75.6
40	1.3	2.4	3.7	5.4	7.3	9.6	15.	21.6	38.4	60.	86.4

PITCHES OF EQUIVALENT STRENGTH FOR THE TEETH OF WHEELS IN DIFFEREMT MATERIALS.

Pitch for cast-iron = 1.00
" brass = 1.12
" hard wood = 1.26

Hosted by Google

GRAFF TUBE WORKS.

WILLIAM GRAFF & CO.

MANUFACTURERS OF

PLAIN AND GALVANIZED

WROUGHT IRON PIPE,

FOR GAS, STEAM, WATER, OIL, &c.

No. 140 First Avenue, - Pittsburgh, Pa.

PIPE CUT AND FITTED TO PLANS FOR MILLS.

ALEXANDER SPEER, President. W. P. PORTER, Sup't. JAMES H. MURDOCK, Sec. & Treas.

PITTSBURGH FORGE AND IRON CO.

MANUFACTURERS OF

PF&I, VC, & XVC BRANDS OF IRON,

FISH PLATES, TRACK BOLTS,

R. R. CAR and LOCOMOTIVE AXLES,

RAILROAD, STEAMBOAT and MACHINE FORGINGS.

Office, 358 Penn St., Pittsburgh, Pa.

Hosted by Google

Nitro Glycerine.

Geo. W. Mowbray.....North Adams, Mass.....See Page 182

Nut Locks.

Jno. W. Quincy.....New York.....See Page 178
Lock, Nut & Bolt Co. of New York..... " " ..... " 272
Vose, Dinsmore & Co..... " " ..... " 60

Nuts, Hot Pressed.

New Haven Nut Co.. .....New Haven, Conn.....See Page 142

WHEELS—SIZES AND WEIGHT.

Double Plate Wheels.

W. W. Snow's Patent, for Inside or Outside Bearings.

36 in. diameter.....Extra heavy, for Engine Trucks..... 640 lbs.
33 in. " ..... " " " " ..... 600 "
33 in. " ....Engines, Tenders, and Passenger Cars ..... 530 "
30 in. " .....Extra heavy, for Engine Trucks..... 520 "
30 in. " .....Engines, Tenders, and Cars..... 480 "
28 in. " ..... " " " ..... 440 "
26 in. " ..... " " " ..... 380 "
24 in. " ..... " " " ..... 320 "
20 in. " ..... " " " ..... 280 "

Atwood-Washburn Patent Wheels.

36 in. diameter.....Extra heavy, for Engine Trucks..... 62 lbs.
33 in. " ..... " " " " ..... 580 "
33 in. " .....Engine, Tender, and Passenger Cars..... 530 "
33 in. " .....Ordinary and general use..... 500 "
33 in. " .....Light Freight Cars..... 480 "
30 in. " .....Extra heavy, for Engine Trucks..... 510 "
30 in. " .....Engines, Tenders, and Cars..... 480 "
30 in. " .....Light Freight Cars..... 450 "
30 in. " .....Coal Cars ..... 430 "
28 in. " .....Engine Trucks and Tenders..... 430 "
26 in. " ..... " " " ..... 380 "
26 in. " .....Coal Cars, heavy..... 365 "
26 in. " ..... " light..... 345 "
24 in. " .....Engine Trucks and Tenders..... 330 "
20 in. " ..... " " " ..... 280 "

Single Plate Wheels.

33 in., Single Plate.....Freight Cars, heavy..... 500 lbs.
33 in., " ..... " light..... 480 "
30 in., " .....Engine Trucks and Tenders..... 460 "
30 in., " .....Freight and Coal Cars..... 440 "
30 in., " ..... " " " ..... 420 "
28 in., " .....Engine Trucks and Tenders ..... 420 "
26 in., " ..... " " " ..... 375 "
26 in., " .....Coal Cars..... 330 "
24 in., " .....Engine and Tender Trucks..... 330 "
20 in., " ..... " " " ..... 280 "

Engine and Tender Truck Wheels.

With Hollow Spokes and Rim.

36 in. diameter..... ..... 600 lbs.
33 in. " ..... 530 "
30 in. " ..... 480 "
28 in. " ..... 430 "
26 in. " ..... 380 "

Construction Wheels.

24 in. diameter, 3 in. tread, 3/4 in. flange..... 200 lbs
24 in. " 2 in. " 3/4 in. " ..... 140 "
20 in. " 5 in. " 1 1/8 in. " ..... 160 "
20 in. spoke, 5 in. " 1 1/2 in. " ..... 100 "
20 in. " 2 1/2 in. " 3/4 in. " ..... 120 "
16 in. " 2 in. " 3/4 in. " ..... 70 "

Hosted by Google

PLUMB, BURDICT & BARNARD,

BUFFALO, N. Y.

MANUFACTURERS OF

BOLTS,

COACH SCREWS, SKEIN BOLTS,

PATENT

Diamond Neck Carriage Bolts

TIRE, SLEIGH SHOE,

Machine and Blank Bolts.

Hosted by Google

Nuts, Hot & Cold Pressed.

Providence Tool Co.; H. B. Newhall, Agent.....New York..... See Page 166

Nut Tappers.

Isaac H. Shearman.....Philadelphia, Pa.....See Page 80
Wm. B. Bement & Son..... " ..... " 168

Oakum.

De Grauw, Aymar & Co.....New York .....See Page 112

Office Chairs.

A. L. Hale & Bro.....Chicago, Ill.....See Page 206

Office Furniture.

A. L. Hale & Bro.....Chicago, Ill.....See Page 206
Joseph Churchyard.....Buffalo, N. Y..... " 160

Oil Cabinets.

D. Brewer & Co. .....Philadelphia, Pa.....See Page 246

Oil Cans and Cups.

J. G. Knapp Manufacturing Co.....New York.....See Page 16
Orrin L. Gridley.....Buffalo, N. Y..... " 196
Pancoast & Maule.....Philadelphia..... " 26
Parmelee & Bonnell.....Buffalo, N. Y..... " 202

Oil of Vitriol.

Van Tuyl Manufacturing Co.....New York .....See Page 242

Oils.

Eclipse Lubric Oil Co .....New York.....See Page Facing Title
F. S. Pease.....Buffalo, N. Y.....See Page 100
P. H. Moffat.....Chicago, Ill..... " 190
Wetherill & Bro.....Philadelphia, Pa..... " 52
Wm. B. Browne & Co.....New York..... " 263

Oil Tank Cars.

Snyder Brothers.....Williamsport, Pa.....See Page 46

Oil Well Casing.

Evans, Dalzell & Co.....Pittsburgh, Pa.....See Page 58
Morris, Tasker & Co.....Philadelphia, Pa..... " 36

Oil Well Tubing.

Evans, Dalzell & Co.....Pittsburgh, Pa.....See Page 58
Morris, Tasker & Co.....Philadelphia, Pa..... " 36

Old Rails.

Holmes & Lissberger.....New York .....See Page 84
John W. Quincy..... " ..... " 178
Miller & Smith..... " ..... " 112
O. W. Child ..... " ..... " 262

TESTS OF STEEL AND IRON.

(*Scientific American.*)

Nitric acid will produce a black spot on steel; the darker the spot the harder the steel. Iron, on the contrary, remains bright if touched with nitric acid.

Good steel in its soft state has a curved fracture and a uniform grey lustre; in its hard state a dull, silvery, uniform white. Cracks, threads, or sparkling particles denote bad quality.

Good steel will not bear a white heat without falling to pieces, and will crumble under the hammer at a bright red heat, while at a middling heat it may be drawn out under the hammer to a fine point.

Care should be taken that before attempting to draw it out to a point, the fracture is not concave, and should it be so the end should be filed to an obtuse point before operating. Steel should be drawn out to a fine point and plunged into colp water; the fractured point should scratch glass. To test its toughness, place a fragment on a block of cast iron; if good it may be driven by the blow of a hammer into the cast-iron, if poor it will crush under the blow.

A soft, tough iron, if broken gradually, gives long silky fibres of leaden-grey hue, which twist together and cohere before breaking.

A medium even grain with fibres denotes good iron.

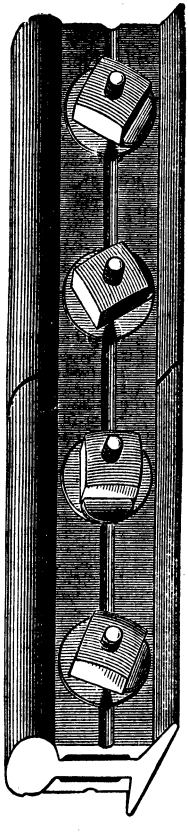
Badly refined iron gives a short blackish fibre on fracture. A very fine grain denotes hard steely iron, likely to be cold-short and hard.

Coarse grain with bright crystallized fracture or discoloured spots denotes cold-short, brittle iron, which works easily when heated and welds well. Cracks on the edge of a bar are indications of hot-short iron. Good iron is readily heated, is soft under the hammer, and throws out few sparks.

Hosted by Google

ANTHRACITE and CHARCOAL PIG IRON, Metals for Railroad Use,

NAILS, SPIKES, &c., &c.



SIMPLE. . . . SECURE. . . . SUBSTANTIAL.

From Report of Judges, American Institute Fair, New York, 1871.

"MOST PERFECT LOCK NUT ON EXHIBITION."

JOHN W. QUINCY,

98 William Street, New York.

N. B.—Old Rail, Wheels, &c., Bought.

Hosted by Google

Open Links.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Orange Mineral.

Wetherill & Bro.....Philadelphia, Pa.....See Page 52

Ottomans, Carpet.

New York Ottoman & Hassock Co.....New York.....See Page 236
Geo. Drake Smith.....Philadelphia, Pa..... " 246

Padlocks.

England & Bindley.....Pittsburgh, Pa.....See Page 162
Hermann Boker & Co.....New York.....See Pages 152, 154
Ritchie & Son.....Newark, N. J.....See Page 44
Romer & Co..... " ..... " 204

Paints.

C. E. Hecht.....Easton, Pa.....See Page 158
H. W. Johns.....New York..... " 224
Jay & Cook..... " " ..... " 234
John W. Masury & Son..... " " ..... " 214
Prince's Metallic Paint Co..... " " ..... " 236
Wetherill & Bro.....Philadelphia, Pa..... " 52
Wm. Green & Co.....Wilmington, Del..... " 248

BEAMS AND CHANNELS.

Sizes and Strength.

(Trenton Iron Works.)

Height in Inches.	Weight per Yd. in Pounds.	Width of Flange in Inches.	Thickness of Webb in Inches.	Co-efficient for Strength.
BEAMS.				
15 1/3	200	5 3/4	.6	748 000
15 9/16	150	5	1/2	551 000
12 7/16	170	5 1/2	.6	511 000
12 1/4	125	4.79	.48	377 000
10 1/2	135	5	.47	360 000
10 1/2	105	4 1/2	3/4	286 000
9	125	4 1/2	.58	268 000
9	85	4	3/8	189 000
9	70	3 1/2	.3	152 000
8	80	4 1/2	3/8	168 000
8	65	4	.3	135 000
7	60	3 1/2	3/8	101 000
6	50	3 1/2	.3	76 800
6	40	3	1/4	62 600
5	40	3	5/16	49 100
5	30	2 3/4	1/4	38 700
4	37	3	5/16	36 800
4	30	2 3/4	1/4	30 100
CHANNELS.				
12 1/4	140	4	11/16	384 000
12 1/4	85	3	7/16	242 000
9	70	3 1/8	7/16	147 000
9	50	2 1/2	.34	101 000
6	45	2 1/2	3/8	55 400
6	33	2 1/4	.28	41 800

To find the safe load in pounds when the beam is supported at each end, and the load is uniformly distributed over the span.

RULE—Divide the number given for the beam in the column headed "Co-efficient for Strength," by the distance between supports estimated in feet. The load so found will be nearly one-third of the ultimate or breaking strength of the beam. When the load is concentrated entirely at the centre of the beam, one-half the above amount must be taken.

The Deflection in inches, at the middle of the span, for such distribnted load, will be found by dividing the square of the span, taken in feet, by seventy (70) times the depth of the beam, taken in inches.

Example—What uniformly distributed load will a 12 1/4 inch beam of 125 lbs. per yard, and having a clear span of 15 feet, bear with safety, and what will be the deflection under this load?

$$\text{Ans.}\ \frac{377000}{15} = 25{,}133 \text{ lbs.} = \text{Safe Load.}$$

$$\frac{15 \times 15}{70 \times 12\tfrac{1}{4}} = 0.26 \text{ in.} = \text{Deflection.}$$

As larger co-efficients for similar beams are given by some other makers, it is proper to add that such co-efficients are based upon a larger proportion of the ultimate strength than is sanctioned by any good authority for practical use, and not upon any difference in the section or quality of the beam.

Hosted by Google

Howe's U. S. Standard Scales.

Baggage AND Express Barrows.

Railroad AND Warehouse Trucks.

SEND FOR PRICES AND PLANS.

A. M. GILBERT & CO.,

38 State Street, Chicago.

GILBERT, WEEKS & CO.,

11 So. Main St., St. Louis.

J. T. RYERSON,

Boiler Makers' Supply House,

Nos. 218, 220, 222 & 224 South Water St., CHICAGO, ILL.

DEALER IN

EXTRA AND REFINED IRONS.

QUALITY MADE A SPECIALTY.

"SLIGO," "U. S." "S. F. B." Boiler Plates.
SLIGO WORKS, Plates, Bars and Rods.
CENTRAL WORKS, Standard Plates.
WAYNE WORKS, U. S. Plates and Bars.
MORRIS, TASKER & CO., Boiler Tubes and Pipe.
BURDEN & SONS, Boiler Rivets.
JUNIATA Tank and Sheet Rivets.
TANK and SHEET IRON, ANGLE IRON, &c.
AND THE EXTRA AND WELL-KNOWN
ULSTER IRON, BARS and RODS.

☞ I have the exclusive sale in Chicago of most of the above lines of SUPERIOR GRADES OF GOODS.

J. T. RYERSON.

Hosted by Google

Paints for Railroads.

C. E. Hecht.....Easton, Pa.....See Page 158
John W. Masury & Son.....New York..... " 214
Prince's Metallic Paint Co..... " " ..... " 236
See also, Paints.

Parallel Bench Vise.

R. L. Howard & Son.....Buffalo, N. Y.....See Page 40

Passenger Cars.

Greene & Randolph.....New York.....See Page 54
O. W. Child..... " " ..... " 262
See also, Car Builders.

Patch Bolts for Boilers.

Pittsburgh Bolt Co.....Pittsburgh, Pa.....See Page 118

Patent Cold Rolled Shafting.

Geo. V. Cresson.....Philadelphia, Pa.....See Page 138
Jones & Laughlins.....Pittsburgh, Pa..... " 32

Patent Couplings.

Geo. V. Cresson.....Philadelphia, Pa.....See Page 138

Paving Tools.

Nelson Tool Wooks.....New York.....See Page 30

Pens.

Joseph Gillott & Sons.....New York.....See Page 86

Permanent Wood Filling.

Valentine & Co.....New York.....See Page 198

CROWNS OF ARCHES.

Thickness required for Crowns of Arches.

(Hurst.)

Radius of Curvature.	Stone Arches.	Brick Arches.	Radius of Curvature.	Stone Arches.	Brick Arches.	Radius of Curvature.	Stone Arches.	Brick Arches.
Feet.	Feet.	Feet.	Feet.	Feet.	Feet	Feet.	Feet.	Feet.
2	.42	.56	14	1.12	1.50	60	2.33	3.10
2½	.47	.63	15	1.16	1.55	65	2.42	3.22
3	.52	.69	16	1.20	1.60	70	2.51	3.35
3½	.56	.75	17	1.24	1.65	75	2.60	3.46
4	.60	.80	18	1.27	1.70	80	2.68	3.58
4½	.64	.85	19	1.32	1.74	85	2.77	3.69
5	.67	.90	20	1.34	1.79	90	2.85	3.80
5½	.71	.94	22	1.41	1.88	95	2.92	3.90
6	.74	.98	24	1 47	1.96	100	3.00	4.00
7	.80	1.06	25	1.50	2.00	110	3.15	4.20
8	.85	1.13	30	1.64	2.19	120	3.29	4.38
9	.90	1.20	35	1.78	2.37	130	3.42	4.56
10	.95	1.26	40	1.90	2.53	140	3.35	4.73
11	1.00	1.33	45	2.01	2.68	150	3.67	4.90
12	1.04	1.38	50	2.12	2.83	160	3.80	5.06
13	1.08	1.44	55	2.22	2.97	170	4.18	5.58

PASTE THAT WILL KEEP A YEAR.

Dissolve a teaspoonful of alum in a quart of warm water. When cold, stir in as much flour as will make it the consistency of thick cream, being particular to beat up all the lumps; stir in as much powdered resin as will stand on a dime, and pour in a few drops of oil of cloves to give it a pleasant odor. Have on the fire a teacupful of boiling water; pour the flour mixture into it, stirring well all the time. In a few minutes it will be of the consistency of mush. Pour it into an earthen or china vessel; let it cool; lay a cover on, and put it in a cool place. When needed for use, take out a portion and soften it with warm water. Paste thus made will last twelve months. It is better than gum, as it does not gloss the paper, and can be written upon.

Hosted by Google

HOOSAC TUNNEL

Tri-Nitro-Glycerin

AND

Gutta Percha Works.

NORTH ADAMS, MASS.

GEO. M. MOWBRAY, Proprietor.

ALSO,

Mowbray's Tri-Nitro-Glycerin Works, Maysville, Kentucky.

JOHN WALLACE, Superintendent.

AND

Mowbray's Tri-Nitro-Glycerin Works, Kingston, Province Ontario, Canada

H. H. PRATT, Superintendent.

MAGAZINES:

Sing Sing, New York.
Cape Rouge, Province of Quebec, Canada.
Poultney, Vermont.
Ottawa, Province of Ontario, Canada.
Kanawaha Falls, West Virginia.

The Tri-Nitro-Glycerin manufactured under the Mowbray Patent is safer to handle, has 30 per cent. more explosive force, and is a more stable compound than can be made by the Nobel process. Our fuses are safe to handle, and are sure fire. I import from Singapore, selected Gum Gutta Percha, having been driven to this by reason of the adulterated Gum in the market, and insulate copper wire by means of machinery (the result of many years' investigation) with the sole view to render blasting with Nitro-Glycerin perfectly safe and 50 per cent. cheaper than with powder. Proved to have more than double the force in blasting over Dualin, Dynamite, Giant Powder, and other secret preparations composed of inferior Nitro-Glycerin with inert matter. We send experienced men to instruct the miners in using it economically and safely, and have never failed in giving satisfactory results, during the past four years,

Hosted by Google

Picks.

England & Bindley.....Pittsburgh, Pa.....See Page 162
G. B. Walbridge.....New York..... " 130
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Hermann Boker & Co.....New York.....See Pages 152, 154
Nelson Tool Works..... " " .....See Page 30
Providence Tool Co.; H. B. Newhall, Agent.... " " ..... " 166
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138

Pig Iron.

Chas. W. Matthews .....Philadelphia, Pa.....See Page 38
Collier & Scranton; Oxford Iron Co.....New York..... " 122
E. L. Hedstrom .....Buffalo, N. Y..... " 202
Holmes & Lissberger.....New York..... " 84
John A. Griswold & Co.....Troy, N. Y..... " 50
Jonas S. Heartt & Co..... " " ..... " 134
John W. Quincy.....New York..... " 178
Miller & Smith..... " " ..... " 112
Posts & Kalkman ..... " " ..... " 266
Pratt & Co .....Buffalo, N. Y..... " 132
Rhodes & Bradley.....Chicago, Ill..... " 192
Rogers & Co..... " " ..... " 144

INSTRUCTIONS FOR HANDLING AND USING MOWBRAY'S TRI-NITRO-GLYCERIN.

1. Handle carefully, avoiding a sudden jar or concussion, and be very careful, if any is spilt outside the can, to avoid striking it against any hard substance.

2. When solid, thaw out by placing the cans in a tub of warm water, not hotter than the wrist can bear, first pouring warm water into the can, and always remove the can before adding more hot water to the tub.

3. To fill Cartridges, &c.—Hold the cartridge to be filled over a tray, say two feet by three feet, the bottom of which should be covered with Plaster of Paris (which will not readily explode when saturated with Nitro-Glycerin.) The soiled Plaster of Paris should be frequently renewed.

4. If the Nitro-Glycerin in a liquid state is kept in store or magazine for some time, the cork should be loosely inserted, and a pint of cold water poured in each can, to be frequently poured off and replaced with fresh cold water in warm weather, taking care to retain the bladder under the cork. It is preferable, when ice can be procured, to congeal the Nitro-Glycerin.

5. Use Funnels (gutta-percha if it can be had) for filling water holes. Under no circumstances whatever attempt to tamp the drill holes; it is unnecessary, and may kill the man who attempts it.

6. Hot irons to warm the water, or soldering the cans, will be sure to cause explosions.

7. Never sledge or attempt drilling in a hole or seam where Nitro-Glycerin has been spilled; fire an exploder, which will effectually clear it up.

8. Never pour Nitro-Glycerin into a hole unless perfectly sure that it is a sound hole, or will hold water; if seamy always use cartridges.

9. To obtain the best results with Nitro-Glycerin, drill deep holes, 6 feet or more. Use powerful exploders and well insulated wires, It is cheaper to fire by electric battery with simultaneous explosion, than to fire several holes with tape fuse.

10. Look out after a blast for any unexploded cartridges lying around.

11. Never allow any but the most careful persons to handle or have charge of the Nitro-Glycerin, and insist upon the use of every precaution to prevent an accident or explosion.

12. Never allow empty Glycerin cans to be used for any other purpose, but destroy them by a fuse and exploder, or building a fire under them, first, however, removing them to a safe distance.

13. Examine your cans from time to time, and notice if, at the level of the Nitro-Glycerin, any pin-holes have eaten through; in such case procure a new can, or stone jar, and empty the contents out, not trusting your hold to the upper part of the can, lest it may give way.

14. When solid, or congealed, it is absolutely safe; if possible, therefore, any surplus should be stored surrounded with ice, since no explosion can take place when it is solid.

Hosted by Google

THE ELECTRIC RAILROAD SIGNAL CO.

194 Fulton Street, New York,

Are now prepared to receive orders for the erection of their Improved and Perfected **ELECTRIC SIGNALS,** manufactured under the patents of **F. L. POPE and S. C. HENDRICKSON.** Our Improved

ELECTRIC SEMAPHORE

can be operated at any distance, and its indications are instantly and infallibly **REPEATED BACK** to the signalman on the same wire. For STATIONS, TUNNELS, BRIDGES, and SECTIONS OF SINGLE TRACK, this Signal is invaluable. We also furnish an

AUTOMATIC BLOCK SYSTEM,

which is operated by the trains themselves, a section of the track being brought into the electric circuit. This system is the **ONLY RELIABLE** one for working automatic signals, and is covered by the original patent of F. L. POPE, July 16, 1872. ☞ *Our Signals have been thorougly tested in practical service.* ☜ We also design and erect to order, special Signals for

Draw-Bridges, Crossings, Station-Yards, Etc., Etc.

J. N. ASHLEY, *Business Manager.*

F. L. POPE, *Superintendent.*

J. W. STOVER, *Agent for the New England States.*

F. L. POPE & CO.

194 Fulton Street, New York,

MANUFACTURERS AND DEALERS IN

TELEGRAPH INSTRUMENTS,

APPARATUS AND SUPPLIES,

OF EVERY DESCRIPTION.

We invite the attention of PURCHASING AGENTS and RAILROAD TELEGRAPH SUPERINTENDENTS to our new patterns of

STANDARD TELEGRAPH INSTRUMENTS,

which have been designed **EXPRESSLY FOR RAILROAD SERVICE.** They are of novel and elegant design, superior finish, and especially constructed for **STRENGTH** and **DURABILITY.** ☞ Our magnets are all wound with tested copper wire of 95 PER CENT conductivity, and by a patented process which adds 20 per cent to their working strength.

☞ *Send for our Illustrated Catalogue and Price List of Instruments, Supplies and Material.* ☜

194 FULTON ST., NEW YORK. [P. O. Box 6010.]

Hosted by Google

Pig Lead.

E. W. Blatchford & Co.....Chicago, Ill.....See Page 124
Lucius Hart & Co.....New York..... " 56

Pipe Tongs.

Barwick Wrench Co.....Boston, Mass.....See Page 60

WEIGHTS.

Avoirdupois Weight.

The Grain is the same in Troy, Apothecaries and Avoirdupois Weights.

The standard avoirdu o's pound is the weight of 27.7015 cubic inches of distilled water weighed in the air, at 35 85 degrees Fahr., barometer at 30 inches.

27.343 grains = 1 drachm.

drachms.	ozs.	lbs.	qrs.	cwts.	ton.	French grammes.
1 =	.0625 =	.0039 =	.000139 =	.000035 =	.00000174 =	1.771846
16 =	1 =	.0625 =	.00223 =	.000558 =	.000028 =	28.34954
256 =	16 =	1 =	.0357 =	.00893 =	.000447 =	4[illegible]3.59
7168 =	448 =	28 =	1 =	.25 =	.0125 =	12700
28672 =	1792 =	112 =	4 =	1 =	.05 =	50802
573440 =	35840 =	2240 =	80 =	20 =	1 =	1.016048

A stone = 14 pounds. A quintal = 100 pounds.

Troy Weight.

For Gold, Silver and Precious Metals.

grains.	dwts.	ozs.	lb.	French grammes.
1 =	.04167 =	.00208 =	.0001736 =	.0648
24 =	1 =	.05 =	.004167 =	1.555
480 =	20 =	1 =	.0833 =	31.1035
5760 =	240 =	12 =	1 =	373.242

175 lbs. Troy = 144 Avoirdupois.
lbs. Avoirdupois × .82286 = lbs. Troy.
lbs. Troy × 1.2153 = lbs. Avoirdupois.

The jeweler's Carat is equal, in the United States, to 3.2 grains; in London, to 3.17 grains; in Paris, to 3.18.

Pure Gold is worth	$20.67	per oz. Troy,	or	$18.84	per oz. Avoirdupois.
" Silver "	$1.36	"	"	$1.24	"	"
Standard Gold "	$18.60	"	"	$16.96	"	"
" Silver "	$1.225	"	"	$1.117	"	"

Apothecaries' Weight.

United States and British.

20 grains..... 1 scruple.
3 scruples..... 1 dram = 60 grs.
8 drams..... 1 ounce = 24 scruples = 480 grs.
12 ounces..... 1 pound = 96 drams = 288 scruples = 5760 grains.

In Troy and Apothecaries' weights, the grain, ounce, and pound are the same.

FRENCH WEIGHTS,

Equivalent in Avoirdupois.

	Grains.	Ounces.	Pounds.	Tons. 2240 lbs.
Milligramme	.015433	———	———	———
Centigramme	.154331	.000352	.000022	———
Decigramme	1.54331	.003527	.000220	———
Gramme	15.4331	.035275	.002204	———
Decagramme	154.331	.352758	.022047	———
Hectogramme	1543.31	3.52758	.220473	.000098
Kilogramme	15433.1	35.2758	2.20473	.000984
Myriogramme	———	352.758	22.0473	.009842
Quintal	———	3527.58	220.473	.098425
Millier or Tonne	———	35275.8	2204.73	.984258

Hosted by Google

ELECTRICAL ENGINEERS.

TOWLE & UNGER M'F'G CO.

30 CORTLAND STREET, NEW YORK.

HAMILTON E. TOWLE, Treas. *WM. UNGER, Sup't.*

MANUFACTURERS OF ALL KINDS OF

ELECTRICAL APPARATUS,

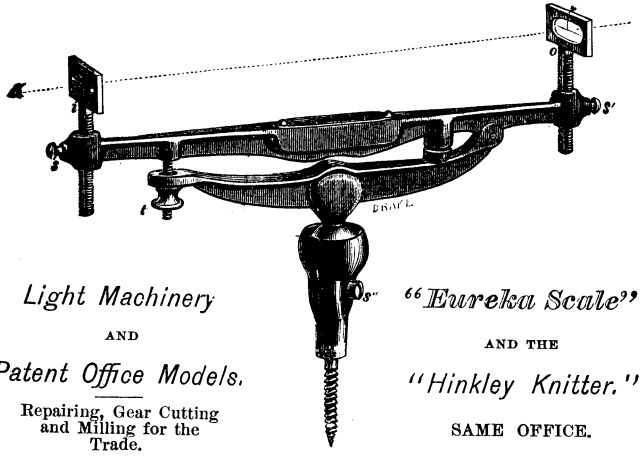
PRINTING, DIAL AND STANDARD

TELEGRAPH INSTRUMENTS.

TOWLE'S PATENT

GRADE AND DRAINAGE LEVEL

Sent to any address on receipt of price, $15.00. Send for descriptive circular.



Light Machinery

AND

Patent Office Models.

Repairing, Gear Cutting and Milling for the Trade.

"Eureka Scale"

AND THE

"Hinkley Knitter."

SAME OFFICE.

THE PRACTICAL APPLICATION OF

MAGNETISM TO MACHINERY A SPECIALTY.

Electric Railroad Signals, (*Pope & Hendrickson's Patents.*)

Hosted by Google

Piston Rods.

Anderson & Woods.....Pittsburgh, Pa.....See Page 150
Jones & Laughlins..... " ..... " 32

Pit Car Wheels.

The Atlas Works.....Pittsburgh, Pa.....See Page 172

Pivot Bridges.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Planes.

England & Bindley..... .....Pittsburgh, Pa.....See Page 162

Planing Machines.

Isaac H. Shearman .....Philadelphia, Pa.....See Page 80
L. W. Pond.....Worcester, Mass..... " 158
The Pratt & Whitney Co..... ....Hartford, Conn..... " 142
Wm. B. Bement & Co.....Philadelphia, Pa..... " 168
Wm. Sellers & Co..... " ..... " 64

Planing Mills.

C. B. Rogers & Co.....New York .....See Page 210

MEASURES.—4 PAGES.

Long Measure.

ins.	feet.	yards.	fath.	poles.	furl.	mile.	French mètres.
1 =	.083 =	.02778 =	.0139 =	.005 =	.000126 =	.0000158 =	.0254
12 =	1 =	.333 =	.1667 =	.0606 =	.00151 =	.0001894 =	.3048
36 =	3 =	1 =	.5 =	.182 =	.00454 =	.000568 =	.9144
72 =	6 =	2 =	1 =	.364 =	.0091 =	.001136 =	1.8287
198 =	16½ =	5½ =	2¾ =	1 =	.025 =	.003125 =	5.0291
7920 =	660 =	220 =	110 =	40 =	1 =	.125 =	201.16
63360 =	5280 =	1760 =	880 =	320 =	8 =	1 =	1609.315

A palm = 3 inches. A span = 9 inches.
A hand = 4 " A cable's length = 120 fathoms.

Surveying Measure (Lineal).

ins.	links.	feet.	yards.	chains.	mile.	French mètres.
1 =	.126 =	.0833 =	.0278 =	.00126 =	.0000158 =	.0254
7.92 =	1 =	.66 =	.22 =	.01 =	.000125 =	.2012
12 =	1.515 =	1 =	.333 =	.01515 =	.000189 =	.3048
36 =	4.545 =	3 =	1 =	.045 5 =	.000568 =	.9144
792 =	100 =	66 =	22 =	1 =	.0125 =	20.116
63360 =	8000 =	5280 =	1760 =	80 =	1 =	1609.315

1 knot or geographical mile = 6082.66 feet = 1854 mètres = 1.152 statute mile.

1 Admiralty knot = 1.1515 = 6080 feet.

FRENCH LONG MEASURE.

	Inches.	Feet.	Yards.	Miles.
Millimetre.....	.03986	.00328	——	——
Centimetre.....	.39368	.0328	——	——
Decimetre	3.9368	.32807	.10935 7	——
Metre.....	39.368	3.2807	1.09357	——
Decametre	393.68	32.807	10.9357	——
Hectometre.....	——	328.07	109.357	.0621347
Kilometre	——	3280.7	1093.57	.6213466
Myriametre	——	32807.	10935.7	6.2134 36

Time.

Seconds.	Minutes.	Hours.	Days.	Weeks.
60 =	1			
3600 =	60 =	1		
86400 =	1440 =	24 =	1	
604800 =	10080 =	168 =	7 =	1

Sidereal Day = 23 h., 56 m., 4.092 sec., in solar or mean time.
Solar Day (mean) = 24 h., 3 m., 56.555 sec., in sideral time.
Sideral year, or revolution of the earth, 365.25635 solar days.
Solar or Calendar Year, 365.24224 solar days.

Hosted by Google

DAVENPORT, FAIRBAIRN & CO.

ERIE, PENN'A,

MANUFACTURERS OF

Engine,

Tender,

AND

Car Wheels.

Moulded by new patent process, and made of best SALISBURY and COPAKE IRONS. The *strongest and most durable* wheels in use.

Capacity, 350 Wheels per Day.

ERIE CAR WORKS,

ERIE, PENN'A,

MANUFACTURERS OF

Stock, Freight, Gravel, Ore and Coal

CARS,

OF BEST MATERIAL AND WORKMANSHIP.

Capacity, Ten Cars per Day.

Hosted by Google

Plated Knobs.

Romer & Co.....Newark, N. J.....See Page 204

Plate Glass.

D. R. Hobart & Co.....New York.....See Page 126
Leffingwell & Co.....Cleveland, Ohio..... " 190

Pliers.

Biddle Manufacturing Co.....New York.....See Page 12

Plow Clevises.

Crane Bros. Manufacturing Co.....Chicago, Ill.....See Page 230

Plows—Railroad.

Nelson Tool Works.....New York.....See Page 30

Plumbers' Castings.

Philadelphia Smelting Co.....Philadelphia, Pa.....See Page 134

Plumbers' Supplies.

A. Carr.....New York.....See Page 244
A. Fulton's Son & Co.....Pittsburgh, Pa..... " 116
McNab & Harlin Manufacturing Co.....New York..... " 220

Plumbers' Tools.

Phelps & Sanger.....Cleveland, Ohio.....See Page 120

Plush Buttons.

L. G. Tillotson & Co.....New York.....See Page 94

Pop Valves.

Posts & Kalkman.....New York.....See Page 266

Porcelain Door Knobs.

Romer & Co.....Newark, N. J.....See Page 204

MEASURES.—Continued.

Square Measure.

ins.	feet.	yards.	perches.	roods.	acre	square mètres.
1 =	.00694 =	.000772 =	.0000255 =	.00000064 =	.000000159 =	.000645
144 =	1 =	.111 =	.00367 =	.0000918 =	.000023 =	.0929
1296 =	9 =	1 =	.0331 =	.000826 =	.0002062 =	.8361
39204 =	272¼ =	30¼ =	1 =	.025 =	.00625 =	25.292
1568160 =	10890 =	1210 =	40 =	1 =	.25 =	1011.7
6272640 =	43560 =	4840 =	160 =	4 =	1 =	4046.7

100 square feet = 1 square.
1 chain wide = 8 acres per mile.
10 square chains = 1 acre.
1 hectare = 2.471143 acres.
1 square mile { = 27878400 sq. feet. = 3097600 sq. yards. = 640 acres. }
Acres × .015625 = square miles.
Sq. yds. × .000000323 = sq. miles.

A section of land is 1 mile square, and contains 640 acres.
A square acre is 208.71 feet at each side.
" ½ " 147.58 " "
" ¼ " 104.355 " "
A circular " 235.504 feet in diameter.
" ½ " 166.527 " "
" ¼ " 117.752 " "

FRENCH SQUARE MEASURE.

	Sq. Ins.	Sq. Feet.	Sq. Yds.	Acres.
Sq. Millimetre	.00154	.0 00107	.000001	——
Sq. Centimetre.	.15498	.0010763	.000119	——
Sq. Decimetre.	15.498	.1076305	.011958	——
Sq. Metre, or Centiare...	1549.8	10.76305	1.19589	.00247
Sq. Decametre of Are...	15498.	1076.305	119.589	.02470
Hectare	——	107630.5	11958.9	2.470 6
Sq. Kilometre.	.38607 sq. miles	1076305.	119589.	247.06
Sq. Myriametre.	38.607 sq. miles	——	——	24708.6

Hosted by Google

W. W. WILCOX,

MANUFACTURER OF

Railroad Baggage Checks,

MARKING CARDS, BADGES, &c.

HOTEL BAGGAGE AND KEY CHECKS.

148 West Van Buren Street,

CHICAGO, ILLINOIS.

LEFFINGWELL & CO.,

IMPORTERS OF

French Plate

GLASS!

Plate sold at New York prices.

WHOLESALE AND RETAIL DEALERS IN

French and American Window and Picture Glass. Ornamental Glass, (Colored, Enameled, Ground, Cut and Embossed.) Rough and Fluted Plate Glass, and Glaziers' Supplies. Diamonds, Putty Points, &c.

LOOKING GLASS PLATES.

No. 67 St. Clair Street, - **CLEVELAND, Ohio.**

P. H. MOFFAT,

9 State Street, Chicago, Ills.

SOLE AGENT FOR

Niles' Iron Co., SHEET and BAR IRON, -	Niles, Ohio
Page & Sprague, LARD OILS, - -	Chicago, Ills.
Geo. A. Stanley, STEARINE CANDLES,	Cleveland, Ohio.
F. M. Backus & Co., LUBRICATING OILS,	" "
Merriam & Morgan, PARAFFINE OILS and AXLE GREASE. -	Cleveland, Ohio.
American Sheet and Boiler Plate Co.,	" "

Hosted by Google

Portable Engines.

Isaac H. Shearman.....Philadelphia, Pa.....See Page 80
J. S. Mundy.....Newark, N. J..... " 266
Rand & Waring Drill & Compressor Co.....New York.....See Front Page
Wm. P. Kellogg & Co.....Troy, N. Y.....See Page 98

Portable Forges.

Newcomb Bros. Sons.....New York.....See Page 88
S. S Townsend..... " " ..... " 2
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138
W. P. Kellogg & Co.....Troy, N. Y..... " 98

Powder.

Laflin & Rand Powder Co.....New York.....See Page next to Back Cover

Power Machines.

Biddle Manufacturing Co.....New York.....See Page 12

Presses—Copying.

T. Shriver & Co.....New York.....See Page 194

Printers.

Allen, Lane & Scott.....Philadelphia, Pa.....See Page 90
Chas. F. Ketcham.....New York..... " 262
Warren, Johnson & Co.....Buffalo, N. Y..... " 100

Pulleys.

Bolen Crane & Co.....Newark, N. J.....See Page 62
Buffalo Machinery Agency.....Buffalo, N. Y..... " 160
Erie City Iron Works.....Erie, Pa..... " 170
Geo. V. Cresson.....Philadelphia, Pa..... " 138
R. L. Howard & Son.....Buffalo, N. Y..... " 40

MEASURES.—CONTINUED.

CUBIC MEASURE.

ins.	feet.	yard.	cubic metrès.
1 =	.0005788 =	.000002144 =	.000016386
1728 =	1 =	.03704 =	.028315
46656 =	27 =	1 =	.764513.

A cord of wood = 128 cubic feet, being 4 feet high, 4 feet wide, and 8 feet long.
42 cubic feet = a ton of sh pping.

A Cubic Foot is Equal to

1728 cubic inches.
.037037 cubic yard.
.803564 U. S. struck bushel of 2150.42 cubic inches.
3.21426 U. S pecks.
7.48052 U. S. liquid galls. of 231 cub. inch.
6.42851 U. S. dry galls.
29.92208 U. S. liquid quarts.
25.71405 U. S. dry quarts
59 84416 U. S. liquid pints.
51.42809 U. S. dry pints.
239.37662 U. S. gills.
.26667 flour barrel of 3 struck bushels.
.23748 U. S. liquid barrel of 31½ galls.

FRENCH CUBIC OR SOLID MEASURE.

	Gill	Pint.	Quart	Gall.	Peck.	Bushel.	Cubic Inches.	Cubic Feet.
Centilitre, Dry.....	—	.0181	—	—	—	—	.61 16	—
Liquid..	.0845	.0211	—	—	—	—		
Decilitre, Dry.....	—	.1816	.0908	—	.0113	—	6.1016	—
Liquid..	.8452	.2113	1.056	.0264	—	—		
Litre, Dry.....	—	1.816	.908	—	.1135	—	61.016	.0353
Liquid..	8.452	2.113	1.056	.2641	—	—		
Decalitre, Dry.....	—	—	9.08	—	1.135	.2837	610.165	.3531
Liquid..	84.52	21.13	10.56	2.641	—	—		
Hectolitre, Dry.....	—	—	90.8	—	11.35	2.837	6101.6	3.531
Liquid..	—	211.3	105.6	26.41	—	—		
Kilolitre or Cubic Meter.....Dry	—	—	—	—	113.5	28.37	61016.	35.31
Liquid..	—	—	1056.5	264.1	—	—		
Myriolitre.....Dry	—	—	—	—	1135.	283.72	—	353.1
Liquid..	—	—	10565.	2641.4	—	—		

Hosted by Google

CHAMPLIN & ROGERS,

No. 155 Fifth, Avenue, CHICAGO, ILL.,

DEALERS IN

Taps, Dies, Reamers, Screws, Screw Plates, Drills, Gas Fitters' Tools, Machine Bits, Car Bits, Emery, Emery Wheels, Emery Grinders, Vises, Set Screws, Belting, Chucks, Wrenches, Lacing, Lathe Dogs, Bolt Dogs, Iron and Steel Clamps, Babbitt Metal, Machinists'

AND

Railroad Supplies,

OF EVERY DESCRIPTION.

Sole Western Agents for

New York Tap and Die Co.
Tanite Co.'s Emery Wheels, Grinders, &c.
Centerbrook Manuf'g Co. (Bits, &c.)
Henry Whiton, (Chucks.)

Manufacturers' Agents for

Stephens Patent Vise Co.
Morse Twist Drill Co.
Reynolds & Co. (Set Screws.)
Le Count's Lathe Dogs, &c.

EVERY VARIETY OF BROWN & SHARPE'S MACHINISTS' TOOLS.

RHODES & BRADLEY,

DEALERS IN

SCOTCH AND AMERICAN

PIG IRON,

Coal and Iron Ores,

Office, 154 Washington St., near La Salle. Dock, Ill. Central Railroad Slips.

CHICAGO.

Hosted by Google

Pumps.

Bolen, Crane & Co.	Newark, N. J.	See Page	62
C. Henry Hall & Co.	New York	"	4
Charles B. Hardick	Brooklyn, N. Y.	"	84
Hart, Ball & Hart	Buffalo, N. Y.	"	136
J. B. Waring	New York	"	24
J. D. West & Co.	" "	"	56
J. J. Walworth	Chicago, Ill.	"	124
J. S. Mundy	Newark, N. J.	"	266
Miller & Smith	New York	"	112
Posts & Kalkman	" "	"	266
Speedwell Iron Works	" "	"	122

Punches and Shears.

Isaac H. Shearman	Philadelphia, Pa.	See Page	80
L. W. Pond	Worcester, Mass.	"	158

Punching and Shearing Machines.

Wm. Sellers & Co.	Philadelphia, Pa.	See Page	64
Wm. B. Bement & Son	"	"	168

Putty.

D. R. Hobart & Co.	New York	See Page	126
Leffingwell & Co.	Cleveland, Ohio	"	190

MEASURES.—CONTINUED.

ALE AND BEER MEASURE. (British).

pints.							
2 =	1 = quart.						
8 =	4 =	1 gallon.					
72 =	36 =	9 =	1 firkin.				
144 =	72 =	18 =	2 = 1 kilderkin.				
288 =	144 =	36 =	4 = 2 = 1 barrel.				
432 =	216 =	54 =	6 = 3 = 1½ = 1 hogshead.				
576 =	288 =	72 =	8 = 4 = 2 = 1⅓ = 1 puncheon.				
864 =	432 =	108 =	12 = 6 = 3 = 2 = 1½ = 1 butt.				

DRY MEASURE.

The Standard Bushel contains 2150.42 cubic inches, or 77.627013 pounds avoirdupois of pure water at maximum density. Its legal dimensions are 18½ inches Diameter inside, 19½ inches outside, and 8 inches deep; and when heaped, the cone must be 6 inches high, making a heaped bushel equal to 1¼ struck ones.

Pints.		Quarts.		Gallons.		Pecks.		Bushels.		Cubic Inches.
2	=	1	=	.250	=	.125	—	.0315	=	67.2
8	—	4	=	1	=	.5	=	.125	=	268.8
16	=	8	=	2	=	1	=	.25	=	537.6
64	=	32	=	8	=	4	=	1	=	2150.42

LIQUID MEASURE.

The standard gallon measures 231 cubic inches, or 8.33888 lbs. avoirdupois of pure water, at about 39.85 degrees Fahr., the barometer at 30 inches.

gills							
4 =	1 pint.						
8 =	2 =	1 quart.					
32 =	8 =	4 =	1 gallon.				
1344 =	336 =	168 =	42 = 1 tierce.				
2016 =	504 =	252 =	63 = 1½ = 1 hogshead.				
2488 =	672 =	336 =	84 = 2 = 1 1-3 = 1 puncheon.				
4032 =	1008 =	504 =	126 = 3 = 2 = 1½ = 1 pipe.				
8064 =	2016 =	1008 =	252 = 6 = 4 = 3 = 2 = 1 tun.				

Cylinders of the following sizes are closely approximating measures.

	Height, inches.		Diameter, inches.		Height, inches.		Diameter, inches.
Gill	3	.....	1¾	Quart	6	.....	3½
½ pint	3⅝	.....	2¼	Gallon	6	.....	7
Pint	3	.....	3½	10 gallons	15	.....	14

A cubic foot contains 7½ gallons.

Hosted by Google

COPYING PRESSES A SPECIALTY.

T. Shriver & Co.

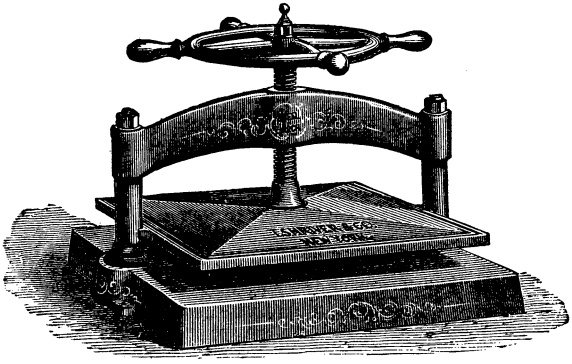
333 East 56th St., Near 2d Ave., New York,

MANUFACTURERS OF

COPYING PRESSES

OF ALL SIZES.

Presses for Railroad Use Specially, 10x13, 12x16, 15x20, 17x22, 22x24.



THIS CUT REPRESENTS OUR

LARGE STEEL ARCH COPYING PRESS,

DESIGNED ESPECIALLY FOR

RAILROAD, EXPRESS,

AND

TRANSPORTATION COMPANIES USE,

The *Arch* is of *Steel;* the Bed Plate is braced by our *Patented* Method, giving very great strength; and all the parts are of proportions to bear the heaviest work in copying large WAY BILLS, MANIFESTS, &c.

Address

T. SHRIVER & CO.,

333 East 56th Street, New York.

Hosted by Google

Quarry Tools.

Nelson Tool Works.....New York.....See Page 30

Railroad Baggage Checks.

W. W. Wilcox.....Chicago, Ill.....See Page 190

Railroad Bonds or Securities.

Geo. H. Crain & Co.....Chicago, Ill.....See Page 124
O. W. Child.....New York..... " 266

Railroad Car Forgings.

De Laney & Co.....Buffalo, N. Y.....See Page 98
Pittsburgh Forge & Iron Co.....Pittsburgh, Pa..... " 174

Railroad Castings.

Bowlers, Maher & Brayton.....Cleveland, Ohio.....See Page 42
Davenport, Fairbairn & Co.....Erie, Pa..... " 188
Jonas S. Heartt & Co.....Troy, N. Y..... " 134
Ramapo Wheel & Foundry Co.....Ramapo, N. Y..... " 256
Wason Manufacturing Co.....Springfield, Mass..... " 146

Railroad Chairs.

Pittsburgh Bolt Co.....Pittsburgh, Pa.....See Page 118

MENSURATION.—2 PAGES.

(*From Hamilton.*)

Mensuration of Surfaces.

Area of any parallelogram..... = base × perpendicular height.
Area of any triangle..... = base × ½ perpendicular height.
Area of any circle..... = diameter² × .7854.
Area of sector of circle..... = arc × ½ radius.
Area of segment of circle..... = area of sector of equal radius, less area of triangle.
Area of parabola..... = base × 2–3 height.
Area of ellipse..... = longest diameter × shortest diameter × .7854.
Area of cycloid..... = area of generating circle × 3.
Area of any regular polygon..... = sum of its sides × perpendicular from its centre to one of its sides ÷ 2.
Surface of cylinder..... = area of both ends + length × circumference.
Surface of cone..... = area of base + circumference of base × ½ slant height.
Surface of sphere..... = diameter² × 3.1415.
Surface of frustrum..... = sum of girt at both ends × ½ slant height + area of both ends.
Surface of cylindrical ring..... = thickness of ring added to the inner diameter × by the thickness × 9.8696.
Surface of segment..... = height of segment × whole circumference of sphere of which it is a part.

POLYGONS.

1. To find the area of any regular polygon. Square one of its sides, and multiply said square by the number in 1st column of the following table.

2. Having a side of a regular polygon, to find the radius of a circumscribing circle. Multiply the side by the corresponding number in the 2d column.

3. Having the radius of a circumscribing circle, to find the side of the inscribed regular polygon. Multiply the radius by the corresponding number in 3d column.

Number of Sides.	Name of Polygon.	1 Area $= S^2 \times$	2 Radius $= S \times$	3 Side $= R \times$	Angle contained betw'n two sides.
3	Equilateral triangle	.433	.5774	1.732	60°
4	Square	1.	.7071	1.4142	90°
5	Pentagon	1.7205	.8507	1.1756	108°
6	Hexagon	2.5891	1.	1.	120°
7	Heptagon	3.6339	1.1524	.8678	128.57°
8	Octagon	4.8284	1.3 66	.7654	135°
9	Nonagon	6.1818	1.4619	.684	140°
10	Decagon	7.6942	1.618	.618	144°
11	Undecagon	9.3656	1.7747	.5635	147.27°
12	Dodecagon	11.1962	1.9319	.5176	150°

In the heads of the columns in above table, S = side, and R = Radius.

Hosted by Google

ESTABLISHED 1836.

SIDNEY SHEPARD & CO.

PROPRIETORS OF THE BUFFALO STAMPING WORKS,

MANUFACTURERS OF

Tinned and Wrought Iron French Ware,

STAMPED and JAPANNED TIN WARE.

DEALERS IN

HARDWARE and METALS, TINMEN'S TOOLS,
MACHINES and FURNISHING GOODS.

68 MAIN STREET, BUFFALO, N. Y.

ORRIN L. GRIDLEY,

MANUFACTURER OF

Rail Road Lanterns,

PATENT EVERLASTING.

Machine Oilers,

AND

Transportation Cans.

46 LLOYD STREET, - BUFFALO, NEW YORK.

HOWE'S SCALES,

OF ALL SIZES AND STYLES, SUITABLE FOR

Railroads, Heavy Manufacturers and Others.

ALSO,

TRUCKS OF ALL VARIETIES,
BAGGAGE AND EXPRESS BARROWS,
FIRE AND BURGLER PROOF SAFES and VAULT WORK.

W. A. DOBINSON & CO.

86 MAIN STREET, BUFFALO, N. Y.,

MANUFACTURERS' AGENTS FOR

Western New York, North Western Pennsylvania, Ohio and Ontario.

Hosted by Google

Railroad Colors and Varnishes.

Edward Smith & Co.....New York.....,.....See Page 218

Railroad Engine Forgings.

De Laney & Co.....Buffalo, N. Y.....See Page 98
Pittsburgh Forge & Iron Co.....Pittsburgh, Pa..... " 174

MENSURATION.—CONTINUED.

PROPERTIES OF THE CIRCLE.

Diameter × 3.14159 = circumference.
Diameter × .8862 = side of an equal square.
Diameter × .7071 = side of an inscribed square.
Diameter^2 × .7854 = area of circle.
Radius × 6.28318 = circumference.
Circumference ÷ 3.14159 = diameter.

The circle contains a greater area than any plane figure, bounded by an equal perimeter or outline.

The areas of circles are to each other as the squares of their diameters.

Any circle whose diameter is double that of another contains four times the area of the other.

Area of a circle is equal to the area of a triangle whose base equals the circumference, and perpendicular equals the radius.

MENSURATION OF SOLIDS.

Cylinder..... = area of one end × length.
Sphere..... = cube of diameter × .5236.
Segment of sphere..... = square root of the height added to three times the square of radius of base × by height and by .5236.
Cone or pyramid..... = area of base × 1-3 perpendicular height.
Frustrum of a cone..... = product of diameter of both ends + sum of their squares, × perpendicular height × .2618.
Frustrum of a pyramid..... = sum of the areas of the two ends + square root of their product, × by 1-3 of the perpendicular height.
Solidity of a wedge..... = area of base × ½ perpendicular height.
Frustrum of a wedge..... = ½ perpendicular height × sum of the areas of the two ends.
Solidity of a ring..... = thickness + inner diameter, × square of the thickness, × 2.4674.

POLYHEDRONS.

No. of sides.	Name.	1 Radius of Circumscribed Circle. R = S×	2 Radius of Inscribed Circle. R = S×	3 Area of Surface. A = S²×	4 Cubic Contents. C = S³×
4	Tetrahedron	.6124	.2041	1.7320	.1178
6	Hexahedron	.866	.5	6.	1.
8	Octahedron	.7071	.4082	3.4641	.4714
12	Dodecahedron	1.4012	1.1135	20.6458	7.6631
20	Icosahedron	.951	.7558	8.6602	2.1817

Side is length of linear edge of any side of the figure.

1.—Radius of Circumscribed Circle = *Side* multiplied by the number in 1st column corresponding to figure.

3.—Radius of Inscribed Circle = *Side* multiplied by the number in 2d column corresponding to figure.

3.—Area of Surface = Square of *side* multiplied by the number in 3d column corresponding to figure.

4.—Cubic Contents = Cube of *side* multiplied by number in 4th column corresponding to figure.

Hosted by Google

VALENTINE & COMPANY,

MAKERS OF

FINE CAR VARNISHES,

88 CHAMBERS STREET, NEW YORK.

☞ Goods put up in 1 and 5 gallon cans, and barrels of 45 gallons. ☜
In latter shape an allowance is made of 20 cents per gallon, to cover difference in cost of barrels and tins. For cash in 30 days, 5% off.

VALENTINES VARNISHES

FINISHING. PER GALLON.

Railway Body Varnish.....$5 50
(For Finishing-coats on Outsides of Cars.)

RUBBING.

Hard Drying Body Varnish..... 5 00
(For under-coats outside, and finishing inside; also, for finishing Locomotives)

Quick Leveling Varnish..... 4 00
(For under-coats on inside work and Locomotives; also for quickening the Railway Body and Hard Drying Body.)

MISCELLANEOUS.

No. 1 Black Varnish..... 1 50
(For smoke-stacks and other iron work.)

Japan Gold-Size..... 3 50
(For binding, drying and hardening colors.)

Crown Coach Japan..... 1 75
(For drying and hardening paints.)

Ground Roughstuff..... 3 00
(For producing a hard and level surface on bodies of Cars.)

Dark Permanent Wood-Filling..... 4 00
(A patent article for priming outside work, and permanently filling and darkening natural woods.)

Light Permanent Wood-Filling..... 4 00
(Precisely same as above, but being light colored, it fills without staining the natural wood, and is specially adapted to priming Cars.)

Hosted by Google

Railroad Iron.

Geo. H. Crain & Co.	Chicago, Ill.	See Page 124
Jno. A. Griswold & Co.	Troy, N. Y.	" 50
Jno. W. Quincy	New York	" 178
Miller & Smith	" "	" 112
O. W. Child	New York	" 262
P. H. Moffat	Chicago, Ill.	" 190
Reese, Graff & Woods	Pittsburgh, Pa.	" 68
Vose, Dinsmore & Co.	New York	" 60
Winans & Co.	" "	" 106

Railroad Machinery.

Schenectady Locomotive Works	Schenectady, N. Y.	See Page 148

Railroad Spike Mauls.

Hermann Boker & Co.	New York	See Pages 152, 154
Skinner & Gifford Manufacturing Co.	" "	See Page 140

Railroad Spikes.

Collier & Scranton; Oxford Iron Co. See also, Spikes.	New York	See Page 122

FOREIGN MONEY, IN U. S. CURRENCY.

(*Condensed from Trautwine.*)

Crown. Great Britain	$1.13
" Portugal	1.12
" Baden, Bavaria, North Germany	1.06
Copeck. Russia	.0075
Dollar. Chili, Mexico, Peru, Bolivia, New Granada	1.00
" Central America	.95
" Norway, Sweden, Spain	1.05
" Rigsbank Dollar, Denmark	.52
" Specie Dollar, Denmark	1.05
Doubloon. Spain, Mexico	15.65
" New Granada	15.34
Drachm. Greece	.18
Ducat. Austria, Bohemia, Hamburg, Hanover	2.28
" Sweden	2.20
" Denmark	1.81
Franc. France, Belgium	.19
5 Franc piece	.95
Florin. Austria, Silesia	.48
" Holland, Netherlands, South Germany	.40
" (gold) Hanover	1.66
" (silver) "	.56
" Prussia	.55
Guilder. Netherland	.40
Gulden. Baden	.40
Guinea. Great Britain	5.08
Groschen. Prussia	.024
5 Groschen. "	.12
Grote. Bremen	.01
Kreutzer. Bavaria	.0067
10 Kreutzer. Austria	.08
Livre. France, Sardinia	.185
" Tuscany, Venice	.16
Lira. Milan	.14
Mark. Denmark	.09
Milrea. Portugal	1.12
Moidore "	6.50
Mohur. Bombay	7.28
" Bengal	8.15
Ounce. Sicily	2.50
Pistola. Rome	3.37
Pistole. Spain	3.90
Paolo. Rome	.10
Peseta. Spain	.20
Pistareen. Spain	.20
Piastre. Spain	1.04
" Egypt	.05
Para	.009
Pound. Great Britain	4.84
" Canada, New Scotia, New Brunswick, Newfoundland	4.00
Reale plate. Spain	.10
" vellon. "	.05
" South America	.0575
2 Reales. Equador	.1875
Rix dollar. Hamburg, Hanover	1.10
" Sweden, Holland	1.05
" Baden, Brunswick	1.00
" Bavaria, Austria, Hungary	.97
Rix 10 thalers. Prussia	8.00
Rixthaler. Prussia, Poland, N. Germany. Bremen, Saxony, Hanover	.69
Rix species thaler. Saxony	.98
Rupee. Bombay, Madras	.45
" Sicca	.53
Reis (1200), Brazil	.99
Rouble. Russia	.79
Schilling. Hamburg	.02
Shilling. Great Britain	.23
Skilling. Denmark	.0075
Scudo. Piedmont	1.36
" Naples, Sicily	.95
" Sardinia	.92
" Rome	1.00
" Genoa	1.28
Soverain. Austria, Bohemia	3.57
Sovereign. Great Britain	4.86
Sous. France nearly	.01
Stiver. Holland "	.02
Teston. Rome	.30
Testoon. Portugal	.12
Zecchin. Turkey	1.40
Zecchina. Rome	2.27

Hosted by Google

Chicago Spring Works,

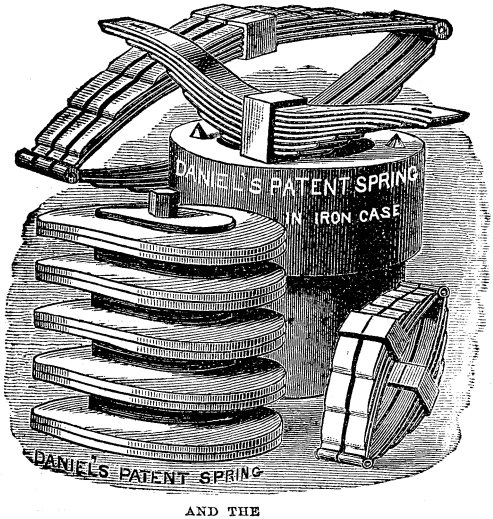
MANUFACTURERS OF

EXTRA TEMPERED

Light Elliptic Cast Steel Springs

FOR CARS AND LOCOMOTIVES.

(PER SPECIFICATION)



AND THE

Daniel's Patent Car Spring,

FOR FREIGHT CARS.

Rates and Terms as low as can be made. Every Spring *fully tested and warranted*, and orders always promptly filled.

F. M. ATKINSON, Pres't and Sup't.

OFFICE and WORKS:

No. 235 South Clinton Street, Chicago.

Hosted by Google

Railroad Supplies.

Atlantic Steel Works	New York	See Page	212
A. Fulton's Son & Co	Pittsburgh, Pa	"	116
Barwick Wrench Co	Boston, Mass	"	60
Buffalo Machinery Agency	Buffalo, N. Y	"	160
Champlin & Rogers	Chicago, Ill	"	192
Charles W. Matthews	Philadelphia, Pa	"	38
George H. Crain & Co	Chicago, Ill	"	124
Greene & Randolph	New York	"	54
George Worthington & Co	Cleveland, Ohio	"	100
H. B. Newhall, Agent	New York	"	166
John Bayliss	" "	"	76
Jones & Laughlins	Pittsburgh, Pa	"	32
Lock Nut & Bolt Co. of New York	New York	"	272
O. W. Child	" "	"	262
Phelps & Sanger	Cleveland, Ohio	"	120
Phillipsburg Manufacturing Co	New York	"	22
Pittsburgh Forge & Iron Co	Pittsburgh, Pa	"	174
Pittsburgh Bolt Co	Pittsburgh, Pa	"	118
Posts & Kalkman	New York	"	266
Pratt & Co	Buffalo, N. Y	"	132
Radley & McAlister Manufacturing Co	New York	"	250
Reese, Graff & Woods	Pittsburgh, Pa	"	68
Skinner & Gifford Manufacturing Co	Dunkirk, N. Y	"	140
S. S. Townsend	New York	"	2
T. B. Bickerton & Co	Philadelphia, Pa	"	138
Winans & Co	New York	"	106
Wm. Green & Co	Wilmington, Del	"	248
Wiard Locomotive Attachment Co	New York	"	110

Railroad Tools.

Nelson Tool Works	New York	See Page	30

Railroad Tickets.

Allen, Lane & Scott	Philadelphia, Pa	See Page	90
Chas. T. Ketcham	New York	"	262
Warren, Johnson & Co	Buffalo, N. Y	"	100

STEEL SPRINGS.

(*Hamilton.*)

Rule 1st—To find elasticity of a given steel-plate spring; Breadth of plate in inches multiplied by cube of the thickness in 1/16 inch, and by number of plates; divide cube of span in inches by prod ct so found, and multiply by 1.66. Result, equal elasticity in 1/16 of an inch per ton of load.

Rule 2d—To find span due to a given elasticity, and number and size of plate; Multiply elasticity in sixteenths per ton, by breadth of plate in inches, and divide by cube of the thickness in inches, and by the number of plates; divide by 1.66 and find cube root of the quotient. Result, equal span in inches.

Rule 3d—To find number of plates due to a given elasticity, span and size of plates: Multiply the cube of the span in inches by 1.66; multiply the elasticity in sixteenths by the breadth of the plate in inches, and by the cube of the thickness in sixteenths; divide the former product by the latter. The quotient is the number of plates.

Rule 4th—To find working strength of a given steel-plate spring: Multiply the breadth of plate in inches by the square of the thickness in sixteenths, and by the number of plates; multiply also the working span in inches by 11.3; divide the former product by the latter. Result, equal working strength in tons burden.

Rule 5th—To find span due to a given strength and number, and size of plate; Multiply the breadth of plate in inches by the square of the thickness in sixteenths, and by the number of plates; multiply, also, the strength in tons by 11.3; divide the former product by the latter. Result equal working span in inches.

Rule 6th—To find the number of plates due to a given strength, span and size of plate: Multiply the strength in tons by span in inches, and divide by 11.3; multiply also the breadth of plate in inches by the square of the thickness in sixteenths; divide the former product by the latter. Result, equal number of plates.

The span is that due to the form of the spring loaded. Extra thick plates must be replaced by an equivalent number of plates of the ruling thickness, before applying the rule. To find this, multiply the number of extra plates by the square of their thickness, and divide by the square of the ruling thickness; conversely, the number of plates of the ruling thickness to be removed for a given number of extra plates, may be found in the same way.

Hosted by Google

PENRHYN SLATE COMPANY,

MANUFACTURERS AND DEALERS IN

ROOFING SLATE

OF ALL KINDS AND COLORS.

MARBLEIZED SLATE MANTLES,

Hearths, Floor Tile and Black Boards.

Quarries and Manufactory, MIDDLE GRANVILLE, Washington Co., New York.

A. F. WATERS, Western Agt., 304 MAIN STREET, **BUFFALO, N. Y.**

E. L. HEDSTROM,

29 SENECA ST., BUFFALO, N. Y.,

WHOLESALE DEALER IN

WILKESBARRE, PITTSTON, LEHIGH AND BLOSSBURG COALS.

IMPORTER OF

Scotch Pig Iron,

SALES AGENT FOR

LAKE SUPERIOR CHARCOAL PIG IRON,

FOR CAR WHEELS AND MALLEABLE IRON.

PARMELEE & BONNELL,

Nos. 55 to 59 Main St., BUFFALO, N. Y.,

MANUFACTURERS OF

Railroad Hand Lanterns,

Railroad Signal Lanterns, THREE COLORS.

Railroad Engineers' Lanterns,

Railroad Conductors' Lanterns,

(BRASS AND NICKEL PLATED.)

Railroad Switch Lights, Patent Bar Oilers, &c.

Hosted by Google

Railroad Track Scales.

Buffalo Scale Company.....Buffalo, N. Y.....See Page 40
Jones Scale Works.....Binghamton, N. Y..... " 92

Rails.

Chas. W. Matthews.....Philadelphia, Pa.....See Page 38
Greene & Randolph.....New York..... " 54
Jones & Laughlins.....Pittsburgh, Pa..... " 32
Jno. W. Quincy.....New York..... " 178
Miller & Smith ..... " " ..... " 112
O. W. Child..... " " ..... " 262
Tyng & Co..... " " ..... " 260
Vose, Dinsmore & Co..... " " ..... " 60

Railway Brakes.

Ward Air Brake Co.....Kalamazoo, Mich.....See Page 56

Ratchets.

Barwick Wrench Co.....Boston, Mass.....See Page 60

Reamers.

Champlin & Rogers.....Chicago, Ill.....See Page 192

Red Lead.

Atlantic White Lead Co.—Rob't Colgate & Co. New York.....See Pages 238, 240
Brooklyn White Lead Co..... " " .....See Page 268
T. B. Bickerton & Co.....Philadelphia, Pa..... " 133
Wetherill & Bro.....Philadelphia, Pa..... " 52

Reflectors.

Radley & McAlister Manufacturing Co..... .....New York.....See Page 250
Vose, Dinsmore & Co..... " " ..... " 60

Retorts.

Philip Neukumet.....Philadelphia, Pa.....See Page 104
Maurer & Weber.....New York..... " 228

Riddles.

Van Tuyl Manufacturing Co.....New York.....See Page 242

Rivet Hammers.

Hermann Boker & Co.....New York.....See Pages 152, 154
Nelson Tool Works..... " " .....See Page 30

Rivet Makers.

Hoopes & Townsend.....Philadelphia, Pa.....See Page 28
J. T. Ryerson.....Chicago, Ill..... ..... " 180
Pittsburgh Bolt Co.....Pittsburgh, Pa..... " 118
Providence Tool Co.; H. B. Newhall, Agent....New York..... " 165

ROOFING SLATE.

General Rule for the Computation of Slate.

(Furnished by the Penrhyn Slate Co.)

From the length of the Slate take three inches, or as many as the third covers the first; divide the remainder by 2, and multiply the quotient by the width of the slate, and the product will be the number of square inches in a single slate. Divide the number of square inch s thus procured by 144, the number of square inches in square foot, and the quotient will be the number of feet and inc es required. A square of slate is what will cover 100 feet square, when properly laid upon the roof.

TABLE OF SIZES AND NUMBER OF SLATE IN ONE SQUARE.

Size in Inches.	No. of Slate in a Square.	Size in Inches.	No. of Slate in a Square.	Size in Inches.	No. of Slate in a Square.	Size in Inches.	No. of Slate in a Square.
6×12	533	9×14	291	10×18	192	11×22	137
7×12	457	10×14	261	11×18	174	12×22	126
8×12	400	12×14	218	12×18	160	14×22	108
9×12	355	8×16	277	14×18	137	12×24	114
10×12	320	9×16	246	10×20	169	14×24	98
12×12	266	10×16	221	11×20	154	16×24	86
7×14	374	12×16	184	12×20	141	14×26	89
8×14	327	9×18	213	14×20	121	16×26	78

THE WEIGHT of a Square of Slate is estimated in a general way (varying according to the thickness of the different makes), at from 600 to 700 lbs. per square.

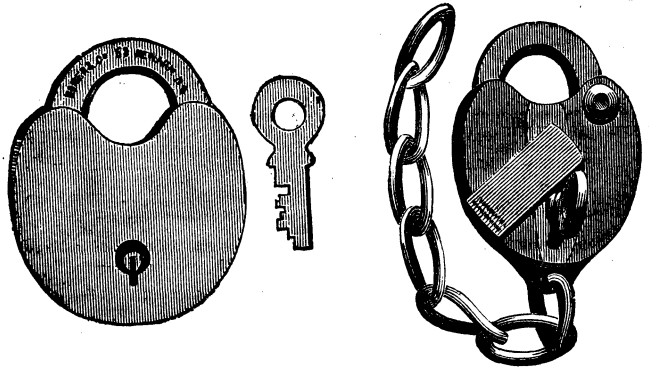
Hosted by Google

ROMER & CO.

(ESTABLISHED IN 1837.)

MANUFACTURERS OF

SWITCH LOCKS,



BRASS and IRON PATENT PADLOCKS

OF EVERY DESCRIPTION.

PATENT STATIONARY RAILROAD

Car Door Locks.

Patent Piano, Sewing Machine Locks,

AND ALL KINDS OF

BRONZE KNOBS AND DOOR TRIMMINGS,

PLATED and PORCELAIN DOOR KNOBS, &c.

Nos. 141 to 145 Railroad Avenue,

NEWARK, N. J.

☞ Illustrated Catalogues sent on application.

Hosted by Google

Rivets.

Bickford, Curtiss & Deming.....Buffalo, N. Y.....See Page 136
D. Brewer & Co.....Philadelphia, Pa..... " 246
N. H. Gardner & Co.....Buffalo, N. Y..... " 254
Wm. Green & Co.....Wilmington, Del..... " 248
See also, Rivet Makers.

Riveting Machines.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Rock Drills.

Rand & Waring Drill & Compressor Co.....New York.....See Front Page

Rods—Measuring.

F. Eckel.....New York.....See Page 76

Rolling Mill Castings.

Bowlers, Maher & Brayton.....Cleveland, Ohio.....See Page 42

Rolling Mill Machinery.

Phelps & Sanger.....Cleveland, Ohio..... .....See Page 120

Roofing Materials.

H. W. Johns.....New York.....See Page 224

Roofing Plates.

Tyng & Co.....New York.....See Page 260

LOCKS AND PADLOCKS.

STANDARD SIZES.

(*Furnished by Romer & Co.*)

BRASS SPRING PADLOCKS.

No.
0, 1 inch Spring Padlock, no Drop.
½, 1⅛ " " "
1, 1¼ " " "
2, 1½ " " "
3, 1¾ " " "
4, 2⅛ " " "
5, 2½ " " "
6, 2⅛ " " plain drop.
7, 2½ " " "
8, 2⅛ " " spring drop
9, 2½ " " "
10, 3 " " "
11, 2½ " Spring Padlock, spring drop and chain.
12, 2⅛ " Spring Padlock, spring drop and chain.
13, 2½ " Spring Padlock, p'ain drop and chain.
14, 2⅛ " Spring Padlock, plain drop and chain.
15, 2½ " heavy R. R. Freight Car Lock, spring drop and chain.
16, 2½ inch heavy Spring Padlock, spring drop, no chain.
17, 2⅝ inch Spring Padlock, spring drop, no chain.
18, 2⅝ inch heavy R. R. Car Lock, spring drop and chain.
19, 3 inch heavy R R. Car Lock, spring drop and chain.
20, 3 inch heavy 3 tumbler R. R. Car Lock and chain.
21, 3 inch heavy 3 tumbler Store Door Padlock, spring drop, no chain.
22, 2½ inch R. R. Switch and Car Lock, spring drop and chain.
23, 2¼ inch 3 tumbler, Spring Lock, spring drop, no chain.
24, 2½ inch 3 tumbler, Spring Lock, spring drop, no chain.
25, 2⅝ inch R R. Freight Car Tumbler Lock, spring drop and chain.

IRON SPRING PADLOCKS.

No.
26, 2¼ inch Spring Padlock, no drop.
27, 2¼ " " brass drop.
28, 2⅝ " " no drop.
29, 2⅝ " " brass drop.
30, 2⅝ " Spring Padlock, brass drop and chain.

SELF-LOCKING TUMBLER BRASS SPRING PADLOCK.

(*Drilled Keys.*)

No.
60, 2 in. Lock, spring drop, no chain.
61, 2 " " and "
62, 2¼ " " no "
63, 2¼ " " and "
64, 2½ " " no "
65, 2½ " " and "
66, 2¾ " " no "
67, 2¾ " " and "
Extra Keys, $1.50 per dozen.

SELF-LOCKING TUMBLER BRASS SPRING PADLOCK.

(*Flat Keys.*)

No.
68, 2 inch Lock, no chain.
69, 2 " " with "
70, 2¼ " " no "
71, 2¼ " " with "
72, 2½ " " no "
73, 2½ " " with "
74, 2¾ " " no "
75, 2¾ " " with "

IMPROVED PASSENGER CAR DOOR LOCKS.

Iron Case, brass inside works and key.
Brass Case, " " " "
Silver Plated Case, brass inside works and key.
Silver Plated Case, with plated knobs, brass inside works and key.

Hosted by Google

A. L. HALE AND BRO.

Wholesale and Retail

Furniture Dealers,

10, 12, 14 AND 16 CANAL STREET,

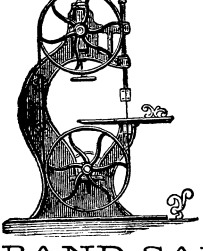
CHICAGO, ILLINOIS.

☞ We have the largest and best stock of Furniture in the West, and make a specialty of

OFFICE FURNISHING.

WOOD WORKING MACHINERY

Molding, Mortising,



TENONING AND SHAPING

MACHINES,

BAND SAWS, SCROLL SAWS,

Planing and Matching Machines, &c.,

FOR RAILROAD, CAR AND AGRICULTURAL SHOPS.

SUPERIOR TO ANY IN USE.

J. A. FAY & CO., CINCINNATI, OHIO.

Hosted by Google

Roofing Slates.

Penrhyn Slate Co.....Buffalo, N. Y.....See Page 202

Ropes.

De Grauw, Aymar & Co.....New York.....See Page 112
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138

Rubber Belting, Hose, &c.

A. Carr.....New York.....See Page 244
A. Fulton's Son & Co.....Pittsburgh, Pa..... " 116
Crane Bros. Manufacturing Co.....Chicago, Ill..... " 230
Goodyear's I. R. G. Manufacturing Co.....New York..... " 252
J. J. Walworth.....Chicago, Ill..... " 124
New York Rubber Co.....New York..... " 260
Phelps & Sanger.....Cleveland, Ohio..... " 120
Radley & McAlister Manufacturing Co.....New York..... " 250
Vose, Dinsmore & Co..... " " ..... " 60

Rubber Goods.

Goodyear's I. R. G. Manufacturing Co.....New York.....See Page 252
L. G. Tillotson & Co..... " " ..... " 94
New York Rubber Co..... " " ..... " 260
Phelps & Sanger.....Cleveland, Ohio..... " 120

Rubber Springs.

Chicago Spring Works.....Chicago, Ill.....See Page 200
Goodyear's I. R. G. Manufacturing Co.....New York..... " 252
Greene & Randolph..... " " ..... " 54
L. G. Tillotson & Co..... " " ..... " 94
New York Rubber Co..... " " ..... " 260
Radley & McAlister Manufacturing Co..... " " ..... " 250
Vose, Dinsmore & Co..... " " ..... " 60

Safes.

W. A. Dobinson & Co.....Buffalo, N. Y.....See Page 196
Warren, Johnson & Co..... " ..... " 100

Safety Fuse.

F. M. Alford.....Avon, Conn.....See Page 158
Geo. W. Mowbray.....North Adams, Mass..... " 182
Laflin & Rand Powder Co.....New York.....See Last Page

Safety Valves.

Geo. W. Richardson & Co.....Troy, N. Y.....See Page 50
Posts & Kalkman.....New York..... " 266

Sandpaper, &c.

England & Bindley.....Pittsburgh, Pa.....See Page 162

Sash and Blind Machinery.

C. B. Rogers & Co.....New York.....See Page 210

Sashes, Doors, &c.

Joseph Churchyard.....Buffalo, N. Y.....See Page 160

WOOD-WORKING MACHINERY.

Velocity of circular-saw at periphery, 6,000 to 7,000 feet per minute.
" the band-saw, 2,500 feet per minute.
" gang-saws, 20-inch stroke, 120 strokes a minute.
" scroll-saws, 300 strokes per minute.
" planing-machine cutters at periphery, 4,000 to 6,000 feet per minute.
Travel of work under planing-machine, 1–20th of an inch for each cut.
" planing-machine cutters, 3,500 to 4,000 feet per minute.
" squaring-up-machine cutters, 7,000 to 8,000 feet per minute.
Speed of wood-carving drills, 5,000 revolutions per minute.
" machine augers, 1½ inch diameter, 900 revolutions per minute.
" machine augers, ¾ inch diameter, 1,200 revolutions per minute.
Gang-saws require for 45 super. feet of pine per hour, 1 HP indicated.
Circular-saws require for 75 super. feet of pine per hour, 1 HP indicated.
In oak or hard wood, ¾ths of the above quantity require 1 HP indicated.

LEATHER GLUE.

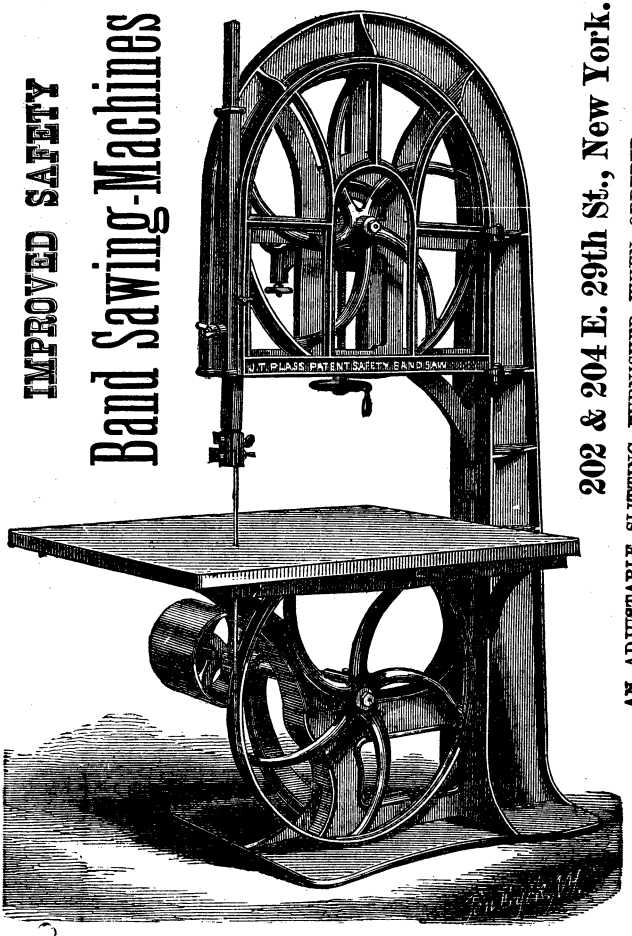
A substance known as "leather glue" is prepared by mixing ten parts of sulphide of carbon with one of oil of turpentine, and adding enough gutta-percha to thicken the mass. The leather surfaces to be united must be freed from oil, which is accomplished by subjecting them to pressure by laying the leather upon blotting paper and applying a hot iron. After tracking together the edges to be joined with the cement, they are to be kept under pressure until the glue is entirely dry.

Hosted by Google

J. T. & R. H. PLASS,

IMPROVED SAFETY

Band Sawing-Machines



202 & 204 E. 29th St., New York.

AN ADJUSTABLE SLITTING FURNISHED WHEN ORDERED.

In all other Band Sawing-Machines the saw is placed outside of the frame and column which support the driving parts, exposing the Saws to injury from handling lumber about them, also rendering them extremely dangerous to the operator. The main feature in this Machine has been to produce a Band Saw, perfectly safe to the operator, and fully protected from injury to the Saw, combining neatness and utility in all its parts. The Saw is placed to run upward near the column, under the top arch, over the upper or tension pulley, and down near the front frame and behind the guide-bar, which can be adjusted up and down to the required height for the work to be done. It also runs through a superior adjustable guide, above and below the work, and a guide on the column, guiding equally well all widths of Saws.

Hosted by Google

Sash Weights.
Crane Bros. Manufacturing Co.....Chicago, Il.....See Page 230
Saw Gummers.
D. Brewer & Co.....Philadelphia, Pa.....See Page 246
Saw Frames.
E. M. Boynton .....New York.....See Page 6
Saw Handles.
E. M. Boynton.....New York.....See Page 6
Saw Makers.
American Saw Company.....New York.....See Page 156
C. Van Ness..... " " ..... " 70
E. M. Boynton..... " " ..... " 6
See also, Saws.
Saw Mill Machinery.
Snyder Bros.....Williamsport, Pa.....See Page 46
Saw Mills.
Buffalo Machinery Agency.....Buffalo, N. Y.....See Page 160
Saws.
American Saw Co.....New York.....See Page 156
C. Van Ness..... " " ..... " 70
E. M. Boynton..... " " ..... " 6
J. T. & R. H. Plass..... " " ..... " 208
Pratt & Co.....Buffalo, N. Y..... " 132
Scales.
A. M. Gilbert & Co.....Chicago, Ill.....See Page 18)
Buffalo Scale Co.....Buffalo, N. Y..... " 40
Jones Scales Works.....Binghamton, N. Y..... " 92
Phelps & Sanger.....Cleveland, Ohio..... " 120
W. A. Dobinson & Co.....Buffalo, N. Y..... " 196
Wm. P. Kellogg & Co.....Troy, N. Y..... " 98
Scientific Books.
D. Van Nostrand.....New York.....See Page 258
Scrapers.
Skinner & Gifford Manufacturing Co.....Dunkirk, N. Y.....See Page 140
Scrap Iron.
Atwater, Wheeler & Co.....New Haven, Conn .....See Page 10
Chas. W. Matthews.....Philadelphia, Pa..... ..... " 38
Screw Bolts.
Lock Nut & Bolt Co. of New York.....New York.....See Page 272
Providence Tool Co; H. B. Newhall, Agent..... " " ..... " 166

TO JOIN THE END OF BAND SAWS.

Furnished by J. T. & R. H. Plass, New York.

File the ends of the band on opposite sides, to form two wedged-shaped ends, having a lap of say ¾ inch long, which, when laid with their beveled and filed sides together shall form a good joint of the same thickness as blade. Now clamp the ends on a piece of board, with the back of the blade toward you, with the lap brought fair together, and see that the back of the blade is straight. Cut a piece of "silver solder," large enough to cover the lap, lay it between the lapped portion with a little pulverized "borax." Now, having a piece cut out of your board, say three inches wide, directly under your lap, heat your soldering tongs to a bright "cherry red," and hold them pinched firmly on the lap until the solder flows freely from under the joint, then cool off the tongs and soldered portion of saw by pouring water upon the same, without relieving the pressure, until nearly cold. Try a file on both sides of the blade, and should it be harder than the other part of the blade, reheat your tongs a little, and draw the temper by pressing the tongs upon the hard portion of blade till partially heated, but not upon the lap, as it will weaken your joint. File off the solder and joint to the same thickness as other parts, and the soldering of your band is completed.

CEMENT FOR LEATHER BELTING.

Take of common glue and American isinglass, equal parts: place them in a boiler and add water sufficient to cover the whole. Let it soak 10 hours, then bring it to a boiling heat, and add pure tannin until the whole becomes ropey or appears like the white of eggs. Apply it warm. Buff the grain off the leather where it is to be cemented; rub the joint surfaces solidly together, let it dry a few hours, and it is ready for practical use; and, if properly put together, it will not need riveting, as the cement is nearly of the same nature as the leather itself.

Hosted by Google

C. B. ROGERS & CO.

MANUFACTURERS OF THE

MOST IMPROVED

WOOD WORKING MACHINERY

FOR

Car Builders, Cabinet Makers, Sash and Blind Work,
Carriage Makers, Planing Mills, &c.

JAMES S. NASON, WAREROOMS, 109 LIBERTY ST.,

NEW YORK.

Manufactory, Norwich, Conn.

WALTER R. WOOD & CO.

MANUFACTURERS and IMPORTERS OF

GRINDSTONES,

Nos. 283 & 285 FRONT STREET,

(Established 1840.) **NEW YORK.**

Quarries at Berea, Amherst and Independence, Ohio.

PRICES MADE FOR DIRECT DELIVERY.

Nova Scotia, New Castle, French and Ohio Grindstones,

SCYTHE STONES, FAMILY GRINDSTONES, &c.

AT OUR NEW YORK YARD.

Hosted by Google

Screw Plates.

Champlin & Rogers.....Chicago, Ill.....See Page 192

Screws.

Geo. Worthington & Co.....Cleveland, Ohio.....See Page 100
Pratt & Co.....Buffalo, N. Y..... " 132
See also, Hardware.

Seal Presses.

Mathiesen & Schrader.....New York.....See Page 82

Self Feeding Hand and Power Drills.

Biddle Manufacturing Co.....New York.....See Page 12

Set Screws.

Champlin & Rogers.....Chicago, Ill.....See Page 192
The Worcester Machine Screw Co.; H. B. Newhall, Agent.....New York..... " 166
Wm. H. Haskell & Co.; H. B. Newhall, Agent " " ..... " 166

Shafting.

Atwater, Wheeler & Co.....New Haven, Conn..... ...See Page 10
Bolen, Crane & Co.....Newark, N. J..... " 62
Buffalo Machinery Agency.....Buffalo, N. Y..... " 160
Erie City Iron Works.....Erie, Pa..... " 170
Geo. V. Cresson.....Philadelphia, Pa..... " 138
Isaac H. Shearman..... " " ..... " 80
Jno. A. Griswold & Co.....Troy, N. Y..... " 50
Jones & Laughlins.....Pittsburgh, Pa..... " 32
J. S. Mundy.....Newark, N. J..... " 266
Pittsburgh Forge & Iron Co.....Pittsburgh, Pa..... " 174
R. L. Howard & Son.....Buffalo, N. Y..... " 40
Reese, Graff & Woods.....Pittsburgh, Pa..... " 68

Shaping Machines.

Isaac H. Shearman.....Philadelphia, Pa.....See Page 80
The Pratt & Whitney Co.....Hartford, Conn..... " 142
Wm. B. Bement & Son.....Philadelphia, Pa..... " 168
Wm. Sellers & Co..... " " ..... " 64

RULES FOR CALCULATING THE SPEED OF DRUMS AND PULLEYS.

(*Furnished by Jas. S. Nason.*)

PROBLEM No. I.—The diameter of the driven being given, to find its number of revolutions.

Rule—Multiply the diameter of the driver by number of its revolutions, and divide the product by the diameter of the driven, the quotient will be the number of revolutions of the driven.

PROBLEM No. II.—The diameter and revolutions of the driver being given, to find the diameter of the driven that shall make any given number of revolutions in the same time.

Rule—Multiply the diameter of the driver by its number of revolutions, and divide the product by the number of revolutions of the driven; the quotient will be its diameter.

PROBLEM No. III.—To ascertain the size of the driver.

Rule—Multiply the diameter of the driven by the number of revolutions you wish it to make, and divide the product by the revolutions of the driver; the quotient will be the diameter of the driver.

WEIGHT OF GRINDSTONES.

RULE: Square the diameter (in inches), multiply by thickness (in inches), then multiply by decimal .06363.

Example: Find the weight of a stone 4 feet 6 inches diameter and 7 inches thick.

4 ft. 6 in. = 54 inches; square of 54=2916; multiplied by 7=20412; multiplied by .06363=*Ans.*, 1298.815 lbs., which is weight of stone.

Hosted by Google

ATLANTIC STEEL WORKS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

CAST STEEL.

CAST TOOL STEEL,

CAST MACHINERY STEEL,

CAST SPRING STEEL,

RAIL ROAD FORGINGS,

CAST STEEL CROW BARS, &c.

RICHARDSON, BOYNTON & CO.

Proprietors,

234 WATER STREET, - - NEW YORK.

CHARLES T. CHESTER,

104 CENTRE STREET, NEW YORK.

Telegraph Engineer.

MANUFACTURER OF

INSTRUMENTS, BATTERIES, AND

Telegraph Material and Supplies

OF EVERY DESCRIPTION.

Chester A I T legraph Wire, unquestionaly the toughest and best Galvanized Iron Wire in the American market. Test—twenty-one full turns to a length of six inches.

Office and Magnet Wires of any size, in any desired quantity.

Screw Glass Insulators. Brackets and Pins, at very low rates.

Submarine Cables of the Celebrated Kerite Wire.

Exclusive Agents of Day's Kerite Wire, for Office, Air, Submarine use; the best insulated and most durable wire in the world.

☞ Illustrated Catalogues, embracing a large amount of new matter and Price Lists for 1873, now ready. **P. O. Box 2766, New York.**

Hosted by Google

Shears and Punches.

L. W. Pond.....Worcester, Mass.....See Page 158
See also, Punches.

Shearing Machines.

Wm. Sellers & Co.....Philadelphia, Pa .....See Page 64

Sheet Iron.

Atwater, Wheeler & Co.....New Haven, Conn.....See Page 10
Bruce & Cook.....New York..... " 112
John Merry & Co..... " " ..... " 48
J. T. Ryerson.....Chicago, Ill..... " 180
Marshall Lefferts, Jr.....New York..... " 44
P. H. Moffat..... Chicago, Ill..... " 190
Radley & McAlister Manufacturing Co.....New York..... " 250
Sidney Shepard & Co..... .....Buffalo, N. Y..... " 196
Wm. Green & Co.....Wilmington, Del..... " 248

Sheet Lead.

Bruce & Cook.....New York.....See Page 112
E. W. Blatchford & Co..... .....Chicago, Ill..... " 124

Sheet Rubber.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116
Goodyear's I. R. G. Manufacturing Co.....New York..... " 252
New York Rubber Co..... " " ..... " 260

Sheet Zinc.

Bruce & Cook.....New York.....See Page 112

Shingles.

Joseph Churchyard.....Buffalo, N. Y.....See Page 160

Shingle Strips.

Reese, Graff & Woods.....Pittsburgh, Pa.....See Page 68

Ship Lanterns.

S. M. Aikman & Co.....New York.....See Page 114

IRON TELEGRAPH WIRE.

TABLE OF LENGTH, SIZE, WEIGHT, STRENGTH, ETC.

(*Charles T. Chester.*)

Birmingham Wire Gauge.	Diameter in Inches.	Weight 100 ft.	Weight 1 Mile, Galvanized.	Weight 1 Mile, not Galvan.	Breaking Strain.	Length of Bundles in Ft.
0	0.340	29.44	1490	1416	7280	213
1	0.300	22.92	1210	1150	5650	273
2	0.280	19.97	1054	1002	4930	315
3	0.260	17.22	909	854	4250	363
4	0·240	11.00	775	747	3620	429
5	0.220	12.34	651	619	3040	510
6	0.200	10.19	538	512	2510	609
7	0.185	8.72	461	438	2220	717
8*	0.170	7.37	389	370	1840	858
9*	0.155	6.12	323	307	1560	1026
10*	0.140	4.99	264	251	1280	1260
11*	0.125	3.98	211	200	1000	1587
12	0.110	3.08	163	157	800	2100
13	0.095	2 35	124	118	568	2679
14	0.085	1.84	97	93	456	3426
15	0.075	1.43	76	73	352	4404
16	0.065	1.08	57	55	264	5862
17	0.057	0.83	44	42	208	7620
18	0.050	0.64	34	32	160	9450
19	0.045	0.52	27	26	128	12255
20	0.040	0.41	21	20	104	14736

* Those marked with star are standard sizes for telegraph use.

Hosted by Google

SUPERFINE PAINTS AND COLORS,

FOR

CAR PAINTING.

☞ These Colors are *Guaranteed Perfectly Pure*, of a fineness that cannot be equalled outside of us.

WE REFER TO

GILBERT BUSH & CO., Troy, N. Y.
WASON CAR COMPANY, Springfield, Mass.
GRANT LOCOMOTIVE WORKS, Paterson, N. J.
BALTIMORE & OHIO RAILROAD COMPANY.
WM. MULLINS, Esq., Purchasing Agent, Pennsylvania Railroad, Pittsburgh, Pa.
MILWAUKIE & ST. PAUL RAILROAD COMPANY, and many others.

SEND FOR SAMPLE BOOK OF COLORS

TO

JOHN W. MASURY & SON,

MANUFACTURERS OF

PURE WHITE LEAD,

ZINC PAINTS,

AND

SUPERFINE COLORS FOR COACH AND CAR WORK.

SPECIALTY IN PURE COLORS.

Office, No. 111 Fulton Street, New York.

Hosted by Google

Shovels.

England & Bindley.....Pittsburgh, Pa.....See Page 162
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
L. G. Tillotson & Co.....New York..... " 94
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138

Signal Oil.

Eclipse Lubric Oil Co.....New York.....See Page Facing Title.
F. S. Pease.....Buffalo, N. Y.....See Page 100
P. H. Moffat.....Chicago, Ill..... " 190
Wm. B. Browne & Co.....New York..... " 266

Signals.

Buffalo Steam Gauge Co.....Buffalo, N. Y.....See Page 170

Slate.

Penrhyn Slate Co.....Buffalo, N. Y.....See Page 202

Slate Roofing Tools.

Nelson Tool Works.....New York.....See Page 30

Sledges.

Nelson Tool Works.....New York.....See Page 30
Wm. Green & Co.....Wilmington, Del..... " 248

Slide Lathes—Self-Acting.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Sliding Tables.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Slotting Machines.

Isaac H. Shearman.....Philadelphia, Pa.....See Page 80
Wm. Sellers & Co..... " " ..... " 64
Wm. B. Bement & Son..... " " ..... " 168

Smelters.

Du Plaine & Reeves.....Philadelphia, Pa.....See Page 102
Hooks Smelting Co..... " " ..... " 216
Philadelphia Smelting Co..... " " ..... " 134

WROUGHT IRON WELDED TUBES, EXTRA STRONG.

Table of Standard Sizes.—(Morris, Tasker & Co.)

Nominal Diameter.	Actual Outside Diameter.	Thickness, Extra Strong.	Thickness, Double Extra Strong.	Actual Inside Diameter, Extra Strong.	Actual Inside Diameter, Double Extra Strong.
1/8	.405	.100	—	.205	—
1/4	.54	.123	—	.294	—
3/8	.675	.127	—	.421	—
1/2	.84	.149	.298	.542	.244
3/4	1.05	.157	.314	.736	.422
1	1.315	.182	.364	.951	.587
1 1/4	1.66	.194	.388	1.272	.885
1 1/2	1.9	.203	.406	1.494	1.088
2	2.375	.221	.442	1.933	1.491
2 1/2	2.875	.280	.560	2.315	1.755
3	3.5	.304	.608	2.892	2.284
3 1/2	4.	.321	.642	3.358	2.716
4	4.5	.341	.682	3.818	3.136

THERMOMETERS.

To convert degrees, Centigrade or Reaumur, into degrees Fahrenheit.

Let F = No. of degrees Fahrenheit.
C = " " Centigrade.
R = " " Reaumur.

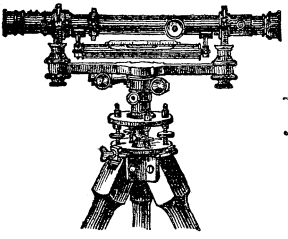
$$F = \frac{9C}{5} + 32 \qquad F = \frac{9R}{4} + 32 \qquad F = C + R + 32$$

$$C = \frac{4(F-32)}{9}. \qquad R = \frac{4(F-32)}{9}.$$

Freezing point, or 32° Fah. = Zero in Cent., or Reaumur.
Boiling point, or 212° Fah. = 100° Cent., or 80° Reaumur.

Hosted by Google

W. KUEBLER. F. SEELHORST.



KUEBLER & SEELHORST,

MANUFACTURERS OF

Mathematical

AND Optical

INSTRUMENTS,

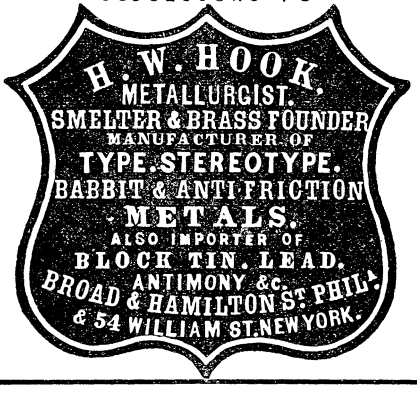
No 27 South Eighth Street, cor. Jayne,

(Entrance on Jayne Street.) PHILADELPHIA.

We call the attention of Engineers to our Patented Improvement on Telescopes.

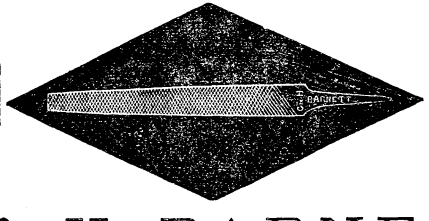
HOOKS SMELTING CO.,

SUCCESSORS TO



BLACK DIAMOND FILE WORKS

TRADE



MARK.

G. & H. BARNETT,

39, 41 & 43 RICHMOND ST., PHILADELPHIA.

Hosted by Google

Smiths' Tools.

England & Bindley.....Pittsburgh, Pa.....See Page 162
Nelson Tool Works.....New York..... " 30
S. S. Townsend.....New York..... " 2

Smoke Stacks.

Radley & McAlister Manufacturing Co.....New York.....See Page 250

Socket Pipes.

R. A. Brick & Co.....New York.....See Page 48

Solder.

Du Plaine & Reeves.....Philadelphia, Pa.....See Page 102
Holmes & Lissberger.....New York..... " 84
Lucius Hart & Co..... " " ..... " 56

Spades.

Vose, Dinsmore & Co.....New York.....See Page 60

Spark Arresters.

Radley & McAlister Manufacturing Co.....New York.....See Page 250

Spelter.

Holmes & Lissberger.....New York.....See Page 84
Lucius Hart & Co..... " " ..... " 56
Philadelphia Smelting Co.....Philadelphia, Pa..... " 134
Wm. Green & Co.....Wilmington, Del..... " 248

Sperm Oil.

F. S. Pease.....Buffalo, N. Y.....See Page 100
P. H. Moffat.....Chicago, Ill..... " 190
Wm. B. Browne & Co.....New York..... " 266

TELEGRAPH MAGNET AND OFFICE WIRES.

TABLE SHOWING THE NUMBER OF FEET BARE COPPER WIRE TO THE POUND.

(*Chas. T. Chester.*)

Birmingham Wire Gauge.	Diameter in Ins.	No. of Feet Bare Wire in lb.	Birmingham Wire Gauge.	Diameter in Ins.	No. of Feet Bare Wire in lb.
1	.300	3.82	21	.035	280.1
2	.280	4.44	*22	.030	381.6
3	.260	5.09	*23	.027	450.0
4	.240	6.00	*24	.025	533.1
5	.220	7.11	25	.023	630.0
6	.200	8.61	*26	.019	923.4
7	.185	10.09	27	.018	1029.0
8	.170	11.91	*28	.016	1302.0
9	.155	14.32	29	.015	1481.4
10	.140	17.50	*30	.014	1708.5
11	.125	22.1	31	.012	2314.8
*12	.110	28.4	*32	.010	3333.3
*13	.095	37.2	33	.009	3421.4
*14	.085	48.0	*34	.0096	3616.8
15	.075	61.3	35	.0087	4399.8
*16	.065	81.9	36	.0079	5349.0
17	.057	106.1	37	.0067	7425.6
*18	.050	137.9	38	.0058	9908.7
19	.045	161.3	39	.0042	18896.1
*20	.040	215.6	40	.0039	21915.0

* Standard Sizes.

The following are the conducting powers of the several Coppers, 100 being the standard for chemically pure:

Lake Superior Native, not fused	98.8 at 15.5
" " fused, as it comes in commerce	92.6 " 15.0
Burra Burra	88.7 " 14.0
Best Selected	81.3 " 14.2
Bright Copper Wire	72.2 " 15.7
Tough Copper	71.0 " 17.3
Demidoff	59.3 " 12.7
Rio Tinto	14.2 " 14.8

Hosted by Google

EDWARD SMITH & CO.

MANUFACTURERS OF

CAR VARNISHES,

AND **SOLE AGENTS** FOR

POST'S COACH COLORS.

161 WILLIAM STREET, NEW YORK.

ESTABLISHED 1827.

J. H. POST & CO.

CHESTER, CONN.,

ONLY MANUFACTURERS OF

Post's Coach Colors

FOR

Car and Coach Work.

EDWARD SMITH & CO.,

SOLE AGENTS,

161 WILLIAM STREET, NEW YORK.

Hosted by Google

Spiegeleisen.

Hermann Boker & Co.....New York.....See Page 152, 154

Spike Mauls.

Skinner & Gifford Manufacturing Co.....Dunkirk, N. Y.....See Page 140

Spikes.

Collier & Scranton; Oxford Iron Co.....New York.....See Page 122
England & Bindley.....Pittsburgh, Pa..... " 162
G. B. Walbridge.....New York..... " 130
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Greene & Randolph.....New York..... " 54
Jno. W. Quincy..... " " ..... " 178
Jones & Laughlins.....Pittsburgh, Pa..... " 32
Lock Nut & Bolt Co. of New York.....New York..... " 272
Marshall Lefferts, Jr.—(Galvanized Spikes)..... " " ..... " 44
Miller & Smith..... " " ..... " 112
O. W. Child..... " " ..... " 262
Pratt & Co—(Rail, Bridge, and Boat).....Buffalo, N. Y..... " 132
Wm. Green & Co.....Wilmington, Del..... " 248

SIDES OF SQUARES.

Equal in Area to a Circle of any Diameter.

(Condensed from Haswell.)

Diam. of Circle.	Side of Equal Square.	Diam. of Circle.	Side of Equal Square.	Diam. of Circle.	Side of Equal Square.	Diam. of Circle.	Side of Equal Square.	Diam. of Circle.	Side of Equal Square.
1	.886	21	18.611	41	36.335	61	54.06	81	71.784
½	1.329	½	19.054	½	36.778	½	54.503	½	72.227
2	1.772	22	19.497	42	37.221	62	54.946	82	72.67
½	2.215	½	19.94	½	37.664	½	55.389	½	73.113
3	2.658	23	20.383	43	38.108	63	55.832	83	73.557
½	3.102	½	20.826	½	38.551	½	56.275	½	74.
4	3.545	24	21.269	44	38.994	64	56.718	84	74.443
½	3.988	½	21.712	½	39.437	½	57.161	½	74.886
5	4.431	25	22.155	45	39.88	65	57.604	85	75.329
½	4.874	½	22.599	½	40.323	½	58.048	½	75.772
6	5.317	26	23.042	46	40.766	66	58.491	86	76.215
½	5.76	½	23.485	½	41.209	½	58.934	½	76.658
7	6.203	27	23.928	47	41.652	67	59.377	87	77.101
½	6.646	½	24.371	½	42 096	½	59.820	½	77.545
8	7.09	28	24.814	48	42.584	68	60.263	88	77.988
½	7.533	½	25.257	½	42.982	½	60.706	½	78.431
9	7.976	29	25 7	49	43.425	69	61.149	89	78.874
½	8.419	½	26.143	½	43.868	½	61.593	½	79.317
10	8.862	30	26.587	50	44.311	70	62.036	90	79.76
½	9.305	½	27.03	½	44.754	½	62.479	½	80.203
11	9.748	31	27.473	51	45.197	71	62.922	91	80.646
½	10.191	½	27.916	½	45.64	½	63.365	½	81.09
12	10.634	32	28.3 9	52	46.084	72	63.808	92	81.533
½	11.078	½	28.802	½	46.527	½	64.251	½	81.976
13	11.521	33	29.245	53	46.97	73	64.694	93	82.419
½	11.964	½	29.688	½	47.413	½	65.137	½	82.862
14	12.407	34	30.131	54	47.856	74	65.581	94	83.305
½	12.85	½	30.575	½	48.299	½	66.024	½	83.748
15	13.293	35	31.018	55	48.742	75	66.467	95	84.191
½	13.736	½	31.461	½	49.185	½	66.91	½	84.634
16	14.179	36	31 904	56	49.628	76	67.353	96	85.078
½	14.622	½	32.347	½	50.072	½	67.796	½	85.521
17	15.066	37	32.790	57	50.515	77	68.239	97	85.964
½	15.509	½	33.233	½	50.958	½	68.682	½	86.407
18	15.952	38	33.676	58	51.401	78	69.125	98	86.85
½	16.395	½	34.119	½	51.844	½	69.569	½	87.293
19	16.838	39	34.563	59	52.287	79	70.012	99	87.736
½	17 281	½	35.006	½	52.73	½	70.455	½	88.179
20	17.724	40	35.449	60	53.173	80	70.898	100	88.622
½	18.167	½	35.892	½	53.616	½	71.341	½	89.066

Hosted by Google

McNAB & HARLIN MF'G CO.

MANUFACTURERS OF

BRASS COCKS,

FOR

STEAM,

WATER,

AND GAS.

Steam Whistles, Gauge Cocks,

Lubricators, Water Gauges, &c.

IRON PIPE,

AND FITTINGS.

BRASS AND COMPOSITION CASTINGS.

☞ *Illustrated Catalogue* and *Price List* sent by Express on application.

56 JOHN STREET,

Works, Paterson, N. J. NEW YORK.

Hosted by Google

Splice Bars.

Pittsburgh Forge & Iron Co.....Pittsburgh, Pa.....See Page 174
Pittsburgh Bolt Co.....Pittsburgh, Pa..... " 118

Spoons.

Pratt & Co..... .....Buffalo, N. Y.....See Page 132

Springs.

Chicago Spring Works.....Chicago, Ill.....See Page 200
Goodyear's I. R. G. Manufacturing Co.....New York..... " 252
New York Rubber Co..... " " ..... " 260
Vose, Dinsmore & Co..... " " ..... " 60
Wm. Green & Co.....Wilmington, Del..... " 248

Spring Steel.

Anderson & Woods.....Pittsburgh, Pa.....See Page 150
Reese, Graff & Woods..... " " ..... " 68
Wm. Green & Co.....Wilmington, Del..... " 248

Stamps.

Mathies·n & Schrader.....New York.....See Page 82

Staple Manufacturers.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Stationary Engine Forgings.

De Laney & Co.....Buffalo, N. Y.....See Page 98

Stationery.

Chas. F. Ketcham..... .....New York.....See Page 262
Warren, Johnson & Co.....Buffalo, N. Y..... " 100
Wm. J. Young & Son.....Philadelphia, Pa..... " 138

CIRCUMFERENCES AND AREAS OF CIRCLES.

Diam.	Circ.	Area.	Diam.	Circ.	Area.	Diam.	Circ.	Area.
1-32—	.0981	.00076	3¼ -	10.21	8.295	7½—	23.56	44.178
1-16	.1963	.00306		10.60	8.946		23.95	45.663
1-8 -	.3926	.01227	3½—	10.99	9.621	7¾ -	24.34	47.173
3-16	.5890	.02761		11.38	10.320		24.74	48.707
1-4—	.7854	.04908	3¾ -	11.78	11.044	8 —	25.13	50.265
5-16	.9817	.07669		12.17	11.793		25.52	51.848
3-8 -	1.178	.1104	4 —	12.56	12.566	8¼ -	25.91	53.456
7-16	1.374	.1503		12.95	13.364		26.31	55.088
1-2—	1.570	.1963	4¼ -	13.35	14.186	8½—	26.70	56.745
9-16	1.767	.2485		13.74	15.033		27.09	58.426
5-8 -	1.963	.3067	4½—	14.13	15.904	8¾ -	27.48	60.132
11-16	2.159	.3712		14.52	16.800		27.88	61.862
3-4—	2.356	.4417	4¾ -	14.92	17.720	9 —	28.27	63.617
13-16	2.552	.5184		15.31	18.665		28.66	65.396
7-8 -	2.748	.6013	5 —	15.70	19.635	9¼ -	29.05	67.200
15-16	2.945	.6902		16.10	20.629		29.45	69.029
1 —	3.141	.7854	5¼ -	16.49	21.647	9½—	29.84	70.882
	3.534	.9940		16.88	22.690		30.23	72.759
1¼ -	3.927	1.227	5½—	17.27	23.758	9¾ -	30.63	74.662
	4.319	1.484		17.67	24.850		31.02	76.588
1½—	4.712	1.767	5¾ -	18.06	25.967	10 —	31.41	78.539
	5.105	2.073		18.45	27.108		31.80	80.515
1¾ -	5.497	2.405	6 —	18.84	28.274	10¼ -	32.20	82.516
	5.890	2.761		19.24	29.464		32.59	84.540
2 —	6.283	3.141	6¼ -	19.63	30.679	10½—	32.98	86.590
	6.675	3.546		20.02	31.919		33.37	88.664
2¼ -	7.068	3.976	6½—	20.42	33.183	10¾ -	33.77	90.762
	7.461	4.430		20.81	34.471		34.16	92.885
2½—	7.854	4.908	6¾ -	21.20	35 784	11 —	34.55	95.033
	8.246	5.411		21.57	37.122		34.95	97.205
2¾ -	8.639	5.939	7 —	21.99	38.484	11¼ -	35.34	99.402
	9.032	6.491		22.38	39.871		35.73	101.62
3 —	9.424	7.068	7¼ -	22.77	41.282	11½—	36.12	103.86
	9.817	7.669		23.16	42.718		36.52	106.13

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

The Wharton R. R. Safety Switch.

MAIN TRACK UNBROKEN AND CONTINUOUS.

Adopted by numerous Roads, among which are the *Pennsylvania Railroad, Philadelphia, Wilmington & Baltimore Railroad, Baltimore & Potomac Railroad, Northern Central Railroad, Chesapeake & Ohio Railroad, &c.*

☞ For further Information, Drawings and Circulars, apply to

The Wharton Railroad Switch Company,

Office, 28 South Third St.,

PHILADELPHIA.

ALSO,

ELASTIC STEEL CUP WASHERS,

MAKING THE CHEAPEST **EFFECTIVE** JOINT IN USE.

ESTABLISHED 1842. *ESTABLISHED 1842.*

COVERED WIRES,

Made from LAKE SUPERIOR COPPER, *warranted strictly pure,* covered with HEMP, FLAX, LINEN, COTTON, SILK, or other material, for TELEGRAPH INSTRUMENTS, ELECTRO-MAGNETIC MACHINES, PHILOSOPHICAL APPARATUS, and all kinds of ELECTRICAL PURPOSES. *Also,*

Plain, Woven, Enamelled, Shellaced, Paraffined,

AND ALL KINDS OF

TELEGRAPH OFFICE WIRES.

Also, Telegraph Switch Cords,

Many Patterns, *Plain, Woven* and *Braided.* ☞ Parties being partial to any particular kind, need only enclose a small specimen in a letter, and it can be imitated in every particular.

Conducting Cords, Pole Cords and Tinsel.

C. THOMPSON,

(Successor to JOSIAH B. THOMPSON,)

29 North 20th St., Philadelphia, Pa.

Hosted by Google

Steamboat Forgings.

De Laney & Co.....Buffalo, N. Y.....See Page 98
Pittsburgh Forge & Iron Co.....Pittsburgh, Pa..... " 174

Steam Elevators.

Crane Bros. Manufacturing Co.....Chicago, Ill..... See Page 230

Steam Engines.

A. Carr.....New York.....See Page 244
Babcock & Wilcox..... " " ..... " 270
Bolen, Crane & Co.....Newark, N. J..... " 62
Buffalo Machinery Agency.....Buffalo, N. Y..... " 160
C. Henry Hall & Co.....New York..... " 4
Crane Bros. Manufacturing Co.....Chicago, Ill..... " 230
Erie City Iron Works.....Erie, Pa..... " 170
Isaac H. Shearman..... Philadelphia, Pa..... " 80
J. B. Waring.....New York..... " 24
J. S. Mundy.....Newark, N. J..... " 266
Miller & Smith.....New York..... " 112
New York Safety Steam Power Co..... " " ..... " 270
Phelps & Sanger..... .....Cleveland, Ohio..... " 120
Porter, Bell & Co.....Pittsburgh, Pa..... " 128
Rand & Waring Drill & Compressor Co.....New York.....See First Page
R. L. Howard & Son.....Buffalo, N. Y.....See Page 40
Snyder Bros.....Williamsport, Pa..... " 46
Wiard Locomotive Attachment Co.—(Anti-Explosive).....New York..... " 110

CIRCUMFERENCES AND AREAS OF CIRCLES—*Continued.*

Diam.	Circ.	Area.	Diam.	Circ.	Area.	Diam.	Circ.	Area.
11¾	36.91	108.43	16	50.26	201.06	20¼	63.61	322.06
	37.30	110.75		50.65	204.21		64.01	326.05
12	37.69	113.09	16¼	51.05	207.39	20½	64.40	330.06
	38.09	115.46		51.44	210.59		64.79	334.10
12¼	38.48	117.85	16½	51.83	213.82	20¾	65.18	338.16
	38.87	120.27		52.22	217.07		65.58	342.25
12½	39.27	122.71	16¾	52.62	220.35	21	65.97	346.36
	39.66	125.18		53.01	223.65		66.36	350.49
12¾	40.05	127.67	17	53.40	226.98	21¼	66.75	354.65
	40.44	130.19		53.79	230.33		67.15	358.84
13	40.84	132.73	17¼	54.19	233.70	21½	67.54	363.05
	41.23	135.29		54.58	237.10		67.93	367.28
13¼	41.62	137.88	17½	54.97	240.52	21¾	68.32	371.54
	42.01	140.50		55.37	243.97		68.72	375.82
13½	42.41	143.13	17¾	55.76	247.45	22	69.11	380.13
	42.80	145.80		56.16	250.94		69.50	384.46
13¾	43.19	148.48	18	56.54	254.46	22¼	69.90	388.82
	43.58	151.20		56.94	258.01		70.29	393.20
14	43.98	153.93	18¼	57.33	261.58	22½	70.68	397.60
	44.37	156.69		57.72	265.18		71.07	402.03
14¼	44.76	159.48	18½	58.11	268.80	22¾	71.47	406.49
	45.16	162.29		58.51	272.44		71.86	410.97
14½	45 55	165.13	18¾	58.90	276.11	23	72.25	415.47
	45.94	167.98		59.29	279.81		72.64	420.00
14¾	46.33	170.87	19	59.69	283.52	23¼	73.04	424.55
	46.73	173.78		60.08	287.27		73.43	429.13
15	47.12	176.71	19¼	60.47	291.03	23½	73.82	433.73
	47.51	179.67		60.86	294.83		74.21	438.30
15¼	47.90	182.65	19½	61.26	298.64	23¾	74.61	443.01
	48.30	185.66		61.65	302.48		75.	447.69
15½	48.69	188.69	19¾	62.04	306.35	24	75.39	452.39
	49.08	191.74		62.43	310.24		75.79	457.11
15¾	49.48	194.82	20	62.83	314.16	24¼	76.18	461.86
	49.87	197.93		63.22	318.09		76.57	466.63

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

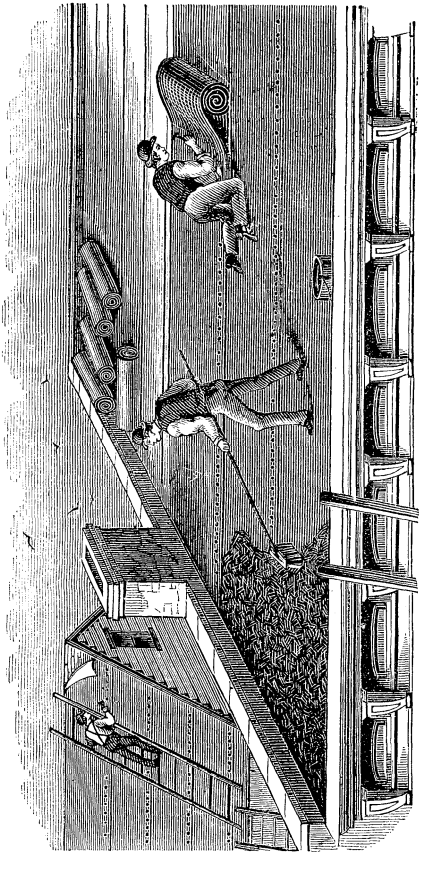
ESTABLISHED 1858.

ASBESTOS ROOFING.

HIGHEST PREMIUM (**MEDAL**) AWARDED AND ENDORSED BY CERTIFICATE FROM THE **AMERICAN INSTITUTE** AS "THE BEST ARTICLE IN THE MARKET."

The "**Asbestos Roofing**" is a substantial and reliable material, which can be safely used in place of Tin, Slate, &c., on steep or flat roofs, in all climates. It is manufactured in rolls ready for use, and can be cheaply transported and easily applied. Also, Manufacturer of

Asbestos Roof Coating and Cement, Asbestos Boiler Felting, Boiler Scale Preventive, Roofing and Sheathing Felts, Paraffine and Marine Paints, Silica Paint Body, Asbestos Board and Paper, Asbestos, Asphaltum, &c.



THESE MATERIALS FOR SALE BY

KIRKWOOD & DUNKLEE, Chicago, Ill. M. M. BUCK & CO., St. Louis, Mo.
RESOR ELBOW M'F'G CO., Cincinnati, O. B. S. PARSONS, Galveston, Texas.
E. A. EDWARDS & CO., San Francisco, Cal.

Send for Descriptive Pamphlets, Price-Lists, &c. Liberal Terms to Dealers.

H. W. JOHNS, SOLE MANUFACTURER,

New Offices, 87 Maiden Lane, (Corner Gold St.) New York.

Hosted by Google

Steam Boilers.

A. Carr	New York	See Page	244
Babcock & Wilcox	" "	"	270
Buffalo Machinery Agency	Buffalo, N. Y.	"	160
C. Henry Hall & Co	New York	"	4
Erie City Iron Works	Erie, Pa	"	170
Isaac H. Shearman	Philadelphia, Pa	"	80
J. B. Waring	New York	"	24
New York Safety Steam Power Co	" "	"	270
Wiard Locomotive Attachment Co.—(Anti-Explosive)	" "	"	110

Steam Fire Engines.

C. Henry Hall & Co	New York	See Page	4
Crane Bros. Manufacturing Co	Chicago, Ill	"	230
George M. Allerton	New York	"	142

Steam Gauges.

A. Carr	New York	See Page	244
A. Fulton's Son & Co	Pittsburgh, Pa	"	116
Buffalo Steam Gauge Co	Buffalo, N. Y.	"	170
J. G. Knapp Manufacturing Co	New York	"	16
J. J. Walworth	Chicago, Ill	"	124
L. G. Tillotson & Co	New York	"	94
McNab & Harlin Manufacturing Co	" "	"	220
Phelps & Sanger	Cleveland, Ohio	"	120
Radley & McAlister Manufacturing Co	New York	"	250
T. B. Bickerton & Co	Philadelphia, Pa	"	138
Vose, Dinsmore & Co	New York	"	60

CIRCUMFERENCES AND AREAS OF CIRCLES—*Continued.*

Diam.	Circ.	Area.	Diam.	Circ.	Area.	Diam.	Circ.	Area.
24¼	76.96	471.43	28¾	90.32	649.18	33	103.6	855.30
	77.36	476.25		90.71	654.83		104.	861.79
24½	77.75	481.10	29	91.10	660.52	33¼	104.4	868.30
	78.14	485.97		91.49	666.22		104.8	874.84
25	78.54	490.87	29¼	91.89	671.95	33½	105.2	881.41
	78.93	495.79		92.28	677.71		105.6	888.00
25¼	79.32	500.74	29½	92.67	683.49	33¾	106.	894.61
	79.71	505.71		93.06	689.29		106.4	901.25
25½	80.10	510.70	29¾	93.46	695.12	34	106.8	907.92
	80.50	515.72		93.85	700.98		107.2	914.61
25¾	80.89	520.70	30	94.24	706.86	34¼	107.5	921.32
	81.28	525.83		94.64	712.76		107.9	928.06
26	81.68	530.93	30¼	95.03	718.69	34½	108.3	934.82
	82.07	536.04		95.42	724.64		108.7	941.60
26¼	82.46	541.18	30½	95.81	730.61	34¾	109.1	948.41
	82.85	546.35		96.21	736.61		109.5	955.25
26½	83.25	551.54	30¾	96.60	742.64	35	109.9	962.11
	83.64	556.76		96.99	748.69		110.3	968.99
26¾	84.03	562.00	31	97.38	754.76	35¼	110.7	975.90
	84.43	567.26		97.78	760.86		111.1	982.84
27	84.82	572.55	31¼	98.17	766.99	35½	111.5	989.80
	85.21	577.87		98.56	773.14		111.9	996.78
27¼	85.60	583.20	31½	98.96	779.31	35¾	112.3	1003.7
	86.	588.57		99.35	785.51		112.7	1010.8
27½	86.39	593.95	31¾	99.74	791.73	36	113.	1017.8
	86.78	599.37		100.1	797.97		113.4	1024.9
27¾	87.17	604.80	32	100.5	804.24	36¼	113.8	1032.0
	87.57	610.26		100.9	810.54		114.2	1039.1
28	87.96	615.75	32¼	101.3	816.86	36½	114.6	1046.3
	88.35	621.26		101.7	823.21		115.	1053.5
28¼	88.75	626.79	32½	102.1	829.57	36¾	115.4	1060.7
	89.14	632.35		102.4	835.97		115.8	1067.9
28½	89.53	637.94	32¾	102.8	842.39	37	116.2	1075.2
	89.92	643.54		103.2	848.83		116.6	1082.4

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

C. M. MOSEMAN & BRO.

MANUFACTURERS OF

HARNESS

AND

Horse Equipments

OF EVERY DESCRIPTION,

FOR

RAILROADS and CONTRACTORS.

ALSO

Farming, Teaming, Carting, Expressing, Livery, Road, Track, Business, AND Pleasure Use.

SINGLE, - - - - - -	FROM $8.00 TO $200.00	PER SET.
DOUBLE. - - - - - -	" $15.00 " $1000.00	" "

BLANKETS, ROBES, SADDLES, BRIDLES, AND HORSE FURNISHING GOODS

OF EVERY DESCRIPTION.

Warehouse, - - 114 Chambers Street,

NEW YORK.

Hosted by Google

Steam Hammers.

Bolen, Crane & Co.....Newark, N. J.....See Page 62
R. Dudgeon..... .....New York..... " 70
Winans & Co..... " " ..... " 106
Wm. B. Bement & Son.....Philadelphia, Pa..... " 168
Wm. Sellers & Co..... " " ..... " 64

Steam Packing.

Goodyear's I. R. G. Manufacturing Co.....New York.....See Page 252
New York Rubber Co.....New York..... " 260
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138

Steam Pumps.

A. Carr.....New York.....See Page 244
A. Fulton's Son & Co.....Pittsburgh, Pa..... " 116
Bolen, Crane & Co.....Newark, N. J..... " 62
Buffalo Machinery Agency.....Buffalo, N. Y..... " 160
C. Henry Hall & Co.....New York..... " 4
Charles B. Hardick.....Brooklyn, N. Y..... " 84
Crane Bros. Manufacturing Co.....Chicago, Ill..... "
Erie City Iron Works.....Erie, Pa..... "
Hart, Ball & Hart..... .....Buffalo, N. Y..... "
Isaac H. Shearman..... .....Phi adelphia, Pa..... "
J. B. Waring.....New York..... "
J. J. Walworth.....Chicago, Ill ..... "
J. S. Mundy.....Newark, N. J..... "
Phelps & Sanger..... .....Cleveland, Ohio..... "
T. B. Bickerton & Co.....Philadelphia, Pa..... "

CIRCUMFERENCES AND AREAS OF CIRCLES—*Continued.*

Diam.	Circ.	Area.	Diam.	Circ.	Area.	Diam.	Circ.	Area.
37¼ —	117.	1089.7	41½ —	130.3	1352.6	45¾ —	143.7	1643.8
	117.4	1097.1		130.7	1360.8		144.1	1652.8
37½ —	117.8	1104.4	41¾ —	131.1	1369.0	46 —	144.5	1661.9
	118.2	1111.8		131.5	1377.2		144.9	1670.9
37¾ —	118.6	1119.2	42 —	131.9	1385.4	46¼ —	145 2	1680.0
	118.9	1126.6		132.3	1393.7		145.6	1689.1
38 —	119.3	1134.1	42¼ —	132.7	1401.9	46½ —	146.	1698.2
	119.7	1141.5		133.1	1410.2		146.4	1707.3
38¼ —	120.1	1149.0	42½ —	133.5	1418.6	46¾ —	146.8	1716.5
	120 5	1156.6		133.9	1426.9		147.2	1725.7
38½ —	120.9	1164.1	42¾ —	134.3	1435.3	47 —	147.6	1734.9
	121.3	1171.7		134.6	1443.7		148.	1744.1
38¾ —	121.7	1179.3	43 —	135.	1452.2	47¼ —	148.4	1753.4
	122.1	1186.9		135.4	1460.6		148.8	1762.7
39 —	122.5	1194.5	43¼ —	135.8	1469.1	47½ —	149.2	1772.0
	122.9	1202.2		136.2	1477.6		149.6	1781.3
39¼ —	123.3	1209.9	43½ —	136.6	1486.1	47¾ —	150.	1790.7
	123.7	1217.6		137.	1494.7		150.4	1800.1
39½ —	124.	1225.4	43¾ —	137.4	1503.3	48 —	150.7	1809.5
	124.4	1233.1		137.8	1511.9		150.1	1818.9
39¾ —	124.8	1240.9	44 —	138.2	1520.5	48¼ —	151.5	1828.4
	125.2	1248.7		138.6	1529.1		151.9	1837.9
40 —	125.6	1256.6	44¼ —	139.	1537.8	48½ —	152.3	1847.4
	126.	1264.5		139.4	1546.5		152.7	1856.9
40¼ —	126.4	1272.3	44½ —	139.8	1555.2	48¾ —	153.1	1866.5
	126.8	1280.3		140.1	1564.0		153.5	1876.1
40½ —	127.2	1288.2	44¾ —	140.5	1572.8	49 —	153.9	1885.7
	127.6	1296.2		140.9	1581.6		154.3	1895.3
40¾ —	128.	1304.2	45 —	141.3	1590.4	49¼ —	154.7	1905.0
	128.4	1312.2		141.7	1599.2		155.1	1914.7
41 —	128.8	1320.2	45¼ —	142.1	1608.1	49½ —	155.5	1924.4
	129.1	1328.3		142.5	1617.0		155.9	1934.1
41¼ —	129.5	1336.4	45½ —	142.9	1625.9	49¾ —	156.2	1943.9
	129.9	1344.5		143.3	1634.9		156.6	1953.6

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

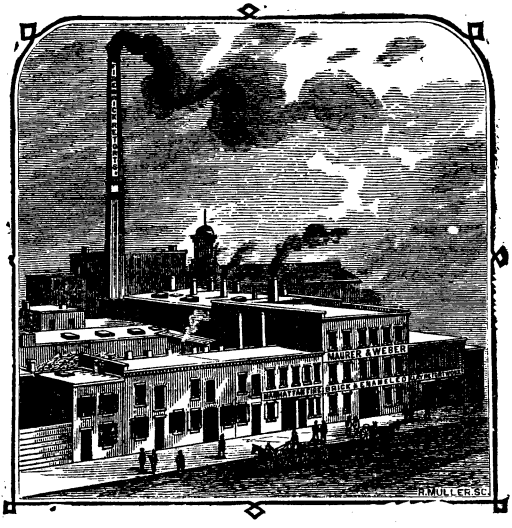
MANHATTAN FIRE BRICK

AND

ENAMELED CLAY RETORT WORKS,

MAURER & WEBER, - - - Proprietors,

Office, 633 East 15th St., New York.



LOCOMOTIVE BLOCKS

GAS AND SUGAR HOUSE RETORTS,

Fire Brick, Tiles, &c.,

OF ALL SHAPES AND SIZES.

SUPERIOR FIRE CLAY,

From our own Clay Beds near Perth Amboy, New Jersey, by the Ton or Cargo.

Hosted by Google

Steam Pipe.

A. Carr.....New York.....See Page 244
Evans, Dalzell & Co.....Pittsburgh, Pa..... " 58
J. J. Walworth.....Chicago, Ill..... " 124
J. T. Ryerson..... " " ..... " 180
Phelps & Sanger.....Cleveland, Ohio..... " 120
Van Tuyl Manufacturing Co.....New York..... " 242
Winans & Co.....New York..... " 106
Wm. Graff & Co.....Pittsburgh, Pa..... " 174

Steam Pipe Covering.

H. W. Johns.....New York.....See Page 224
Van Tuyl Manufacturing Co..... " " ..... " 242

Steamship Lines.

Inman Line.....New York.....See Page 14

Steam Ship Supplies.

Wm. Green & Co.....Wilmington, Del.....See Page 248

Steam Warming Apparatus.

Crane Bros. Manufacturing Co.....Chicago, Ill.....See Page 230

Steam Whistles.

J. J. Walworth.....Chicago, Ill.....See Page 124
McNab & Harlin Manufacturing Co.....New York..... " 220
Pancoast & Maule.....Philadelphia, Pa..... " 26
Vose, Dinsmore & Co.....New York..... " 60

CIRCUMFERENCES AND AREAS OF CIRCLES—*Continued.*

Diam.	Circ.	Area.	Diam.	Circ.	Area.	Diam.	Circ.	Area.
50 —	157.	1963.5	54¼ —	170.4	2311.4	58¼ —	183.7	2687.8
	157.4	1973.3		170.8	2322.1		184.1	2699.3
50¼ —	157.8	1983.1	54½ —	171.2	2332.8	58¾ —	184.5	2710.8
	158.2	1993.0		171.6	2343.5		184.9	2722.4
50½ —	158.6	2002.9	54¾ —	172.	2354.2	59 —	185.3	2733.9
	159.	2012.8		172.3	2365.0		185.7	2745.5
50¾ —	159.4	2022.8	55 —	172.7	2375.8	59¼ —	186.1	2757.1
	159.8	2032.8		173.1	2386.6		186.5	2768.8
51 —	160.2	2042.8	55¼ —	173.5	2397.4	59½ —	186.9	2780.5
	160.6	2052.8		173.9	2408.3		187.3	2792.2
51¼ —	161.	2062.9	55½ —	174.3	2419.2	59¾ —	187.7	2803.9
	161.3	2072.9		174.7	2430.1		188.1	2815.6
51½ —	161.7	2083.0	55¾ —	175.1	2441.0	60 —	188.4	2827.4
	162.1	2093.2		175.5	2452.0		188.8	2839.2
51¾ —	162.5	2103.3	56 —	175.9	2463.0	60¼ —	189.2	2851.0
	162.9	2113.5		176.3	2474.0		189.6	2862.8
52 —	163.3	2123.7	56¼ —	176.7	2485.0	60½ —	190.	2874.7
	163.7	2133.9		177.1	2496.1		190.4	2886.6
52¼ —	164.1	2144.1	56½ —	177.5	2507.1	60¾ —	190.8	2898.5
	164.5	2154.4		177.8	2518.2		191.2	2910.5
52½ —	164.9	2164.7	56¾ —	178.2	2529.4	61 —	191.6	2922.4
	165.3	2175.0		178.6	2540.5		192.	2934.4
52¾ —	165.7	2185.4	57 —	179.	2551.7	61¼ —	192.4	2946.4
	166.1	2195.7		179.4	2562.9		192.8	2958.5
53 —	166.5	2206.1	57¼ —	179.8	2574.1	61½ —	193.2	2970.5
	166.8	2216.6		180.2	2585.4		193.6	2982.6
53¼ —	167.2	2227.0	57½ —	180.6	2596.7	61¾ —	193.9	2994.7
	167.6	2237.5		181.	2608.0		194.3	3006.9
53½ —	168.	2248.0	57¾ —	181.4	2619.3	62 —	194.7	3019.0
	168.4	2258.5		181.8	2630.7		195.1	3031.2
53¾ —	168 8	2269.0	58 —	182.2	2642.0	62¼ —	195.5	3043.4
	169.2	2279.6		182.6	2653.4		195.9	3055.7
54 —	169.6	2290.2	58¼ —	182.9	2664.9	62½ —	196.3	3067.9
	170.	2300.8		183.3	2676.3		196.7	3080.2

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

R. T. CRANE, President.
S. W. ADAMS, Sec'y.

C. S. CRANE, Vice-Pres.
GEO. S. REDFIELD, Treas.

CRANE BROS. MANFG. COMPANY

ESTABLISHED 1855. INCORPORATED 1865.

(*Late the "North Western"*)

Gen'l Offices, 10 N. Jefferson St., CHICAGO,

MANUFACTURERS OF

Wrought Iron Pipe,

STEAM AND GAS FITTINGS, &c.

Crane's Steam Pumps.

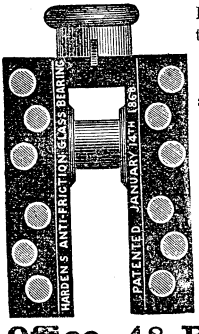
STEAM WARMING & VENTILATING APPARATUS.

Crane's Patent Steam Elevators

For Passengers, Freight, Coal Mines, Blast Furnaces, &c.

HARDEN'S

Anti-Friction Glass Bearings



Have been in practical use for over

FIVE YEARS,

and are now in operation on over

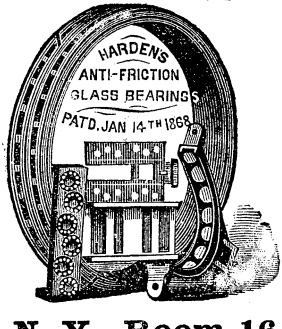
3000

Locomotive,

STATIONARY

AND

MARINE ENGINES.



Office, 48 Broad St., N. Y., Room 16.

Western Office, 65 and 67 South Clinton St., Chicago.

☞ SEND FOR PRICE LIST. ☜

Hosted by Google

Steel.

Anderson & Woods.....Pittsburgh, Pa.....See Page 150
Atlantic Steel Works.....New York..... " 212
Chas. W. Matthews.....Philadelphia, Pa..... " 38
England & Bindley.....Pittsburgh, Pa..... " 162
Poets & Kalkman.....New York..... " 266
Reese, Graff & Woods.....Pittsburgh, Pa..... " 68
Tyng & Co.....New York..... " 260
Wm. Green & Co.....Wilmington, Del..... " 248

See also, Steel Importers and Steel Manufacturers.

Steel Bells.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116
Hermann Boker & Co.....New York.....See Pages 152, 154

Steel Car Springs.

Chicago Spring Works.....Chicago, Ill.....See Page 200
Greene & Randolph.....New York..... " 54
Vose, Dinsmore & Co..... " " ..... " 60

Steel Forgings.

Anderson & Woods.....Pittsburgh, Pa.....See Page 150
Atlantic Steel Works.....New York..... " 212
De Laney & Co.....Buffalo, N. Y..... " 98
Jno. A. Griswold & Co.....Troy, N. Y..... " 50

Steel Frogs.

Anderson & Woods.....Pittsburgh, Pa.....See Page 150
Atlantic Steel Works.....New York..... " 212

CIRCUMFERENCES AND AREAS OF CIRCLES—*Continued.*

Diam.	Circ.	Area.	Diam.	Circ.	Area.	Diam.	Circ.	Area.
62¼	197.1	3092.5	67	210.4	3525.6	71¼	223.8	3987.1
	197.5	3104.8		210.8	3538.8		224.2	4001.1
63	197.9	3117.2	67¼	211.2	3552.0	71½	224.6	4015.1
	198.3	3129.6		211.6	3565.2		225.	4029.2
63¼	198.7	3142.0	67½	212.	3578.4	71¾	225.4	4043.2
	199.	3154.4		212.4	3591.7		225.8	4067.3
63½	199.4	3166.9	67¾	212.8	3605.0	72	226.1	4071.5
	199.8	3179.4		213.2	3618.3		226.5	4085.6
63¾	200.2	3191.9	68	213.6	3631.6	72¼	226.9	4099.8
	200.6	3204.4		214.	3645.0		227.3	4114.0
64	201.	3216.9	68¼	214.4	3658.4	72½	227.7	4128.2
	201.4	3229.5		214.8	3671.8		228.1	4142.5
64¼	201.8	3242.1	68½	215.1	3685.2	72¾	228.5	4156.7
	202.2	3254.8		215.5	3698.7		228.9	4171.0
64½	202.6	3267.4	68¾	215.9	3712.2	73	229.3	4185.3
	203.	3280.1		216.3	3725.7		229.7	4199.7
64¾	203.4	3292.8	69	216.7	3739.2	73¼	230.1	4214.1
	203.8	3205.5		217.1	3752.8		230.5	4228.5
65	204.2	3318.3	69¼	217.5	3766.4	73½	230.9	4242.9
	204.5	3331.0		217.9	3780.0		231.3	4257.3
65¼	204.9	3343.8	69½	218.3	3793.6	73¾	231.6	4271.8
	205.3	3356.7		218.7	3807.3		232.	4286.3
65½	205 7	3369.5	69¾	219.1	3821.0	74	232.4	4300.8
	206.1	3382.4		219.5	3834.7		232.8	4315.3
65¾	206.5	3395.3	70	219.9	3848.4	74¼	233.2	4329.9
	206.9	3408.2		220.3	3862.2		233.6	4344.5
66	207.3	3421.2	70¼	220.6	3875.9	74½	234.	4359.1
	207.7	3434.1		221.	3889.8		234.4	4373.8
66¼	208.1	3447.1	70½	221.4	3903.6	74¾	234.8	4388.4
	208.5	3460.1		221.8	3917.4		235.2	4403.1
66½	208.9	3473.2	70¾	222.2	3931.3	75	235.6	4417.8
	209.3	3486.3		222.6	3945.2		236.	4432.6
66¾	209.7	3499.3	71	223.	3959.2	75¼	236.4	4447.3
	210.	3512.5		223.4	3973.1		236.7	4462.1

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

Star Fire Brick Co.

MANUFACTURERS OF

LOCOMOTIVE BLOCKS,

BLAST FURNACE BLOCKS,

STOVE LININGS,

FIRE BRICK,

AND ALL VARIETIES OF

TILES.

WORKS AND OFFICE:

CORNER 22d and RAILROAD STREETS,

(TWELFTH WARD,)

PITTSBURGH, PA.

W. A. REED,
President and Treasurer.

S. P. HARBISON,
Secretary and Business Manager.

Hosted by Google

Steel Importers.

Atwater, Wheeler & Co.....New Haven, Conn.....See Page 10
Leng & Ogden.....New York...See page next back cover.
Miller & Smith..... .....New York.....See Page 112
Tyng & Co..... " " ..... " 260

Steel Manufacturers.

Anderson & Woods.....Pittsburgh, Pa.....See Page 150
Atlantic Steel Works.....New York..... " 212
Jno. A. Griswold & Co.....Troy, N. Y..... " 50
Reese, Graff & Woods.....Pittsburgh, Pa..... " 68
Vose, Dinsmore & Co.....New York..... " 60

Steel Rails.

Greene & Randolph.....New York.....See Page 54
Hermann Boker & Co..... " " .....See Pages 152, 154
Jno. A. Griswold & Co.....Troy, N Y.....See Page 50
Miller & Smith.....New York..... " 112
O. W. Child..... " " ..... " 262
Tyng & Co..... " " ..... " 260
Vose, Dinsmore & Co..... " " ..... " 60

Steel Springs.

Chicago Spring Works.....Chicago, Ill.....See Page 200
Vose, Dinsmore & Co.....New York..... " 60

Steel Tubes.

Leng & Ogden.....New York. See page next back cover.
Winans & Co..... " " .....See Page 106

CIRCUMFERENCES AND AREAS OF CIRCLES—*Continued.*

Diam.	Circ.	Area.	Diam.	Circ.	Area.	Diam.	Circ.	Area.
75½	237.1	4476.9	79¾	250.5	4995.1	84	263.8	5541.7
	237.5	4491.8		250.9	5010.8		264.2	5558.2
75¾	237.9	4506.6	80	251.3	5026.5	84¼	264.6	5574.8
	238.3	4521.5		251.7	5042.2		265.	5591.3
76	238.7	4536.4	80¼	252.1	5058.0	84½	265.4	5607 9
	239.1	4551.4		252.5	5073.7		265.8	5624.5
76¼	239.5	4566.3	80½	252.8	5089.5	84¾	266.2	5641.1
	239.9	4581.3		253.2	5105 4		266.6	5657.8
76½	240.3	4596.3	80¾	253.6	5121.2	85	267.	5674.5
	240.7	4611.3		254.	5137.1		267.4	5691.2
76¾	241.1	4626.4	81	254.4	5153.0	85¼	267.8	5707.9
	241.5	4641.5		254.8	5168.9		268.2	5724.6
77	241.9	4656.6	81¼	255.2	5184.8	85½	269.6	5741.4
	242.2	4671.7		255.6	5200.8		268.9	5758.2
77¼	242.6	4686.9	81½	256.	5216.8	85¾	269.3	5775.0
	243.	4702.1		256.4	5232.8		269.7	5791.9
77½	243.4	4717.3	81¾	256.8	5248.8	86	270.1	5808.8
	243.8	4732.5		257.2	5264.9		270.5	5825.7
77¾	244.2	4747.7	82	257.6	5281.0	86¼	270.9	5842.6
	244.6	4763.0		258.	5297.1		271.3	5859.5
78	245.	4778.3	82¼	258.3	5313.2	86½	271.7	5876.5
	245.4	4793.7		258.7	5329.4		272.1	5893.5
78¼	245.8	4809.0	82½	259.1	5345.6	86¾	272.5	5910.5
	246.2	4824.4		259.5	5361.8		272.9	5927.6
78½	246.6	4839.8	82¾	259.9	5378.0	87	273.3	5944.6
	247.	4855.2		260.3	5394.3		273.7	5961.7
78¾	247.4	4870.7	83	260.7	5410.6	87¼	274.1	5978.9
	247.7	4886.1		261.1	5426.9		274.4	5996.0
79	248.1	4901.6	83¼	261.5	5443.2	87½	274.8	6013.2
	248.5	4917.2		261.9	5459.6		275.2	6030.4
79¼	248.9	4932.7	83½	262.3	5476.0	87¾	275.6	6047.6
	249.3	4948.3		262.7	5492.4		276.	6064.8
79½	249.7	4963.9	83¾	263.1	5508.8	88	276.4	6082.1
	250.1	4979.5		263.5	5525.3		276.8	6099.4

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

JAY & COOK,

MANUFACTURERS OF

ZINC GLAZIER'S POINTS.

No. 1. No. 2. No. 3. No. 1. No. 2. No. 3.

SHARPS. **TRIANGLES.**

No. 43 Centre Street,

NEW YORK.

Hosted by Google

Steel Tyres.

Anderson & Woods.....Pittsburgh, Pa.....See Page 150
Hermann Boker & Co..... .....New York.....See Pages 152, 124
Jno. A. Griswold & Co.....Troy, N. Y..... See Page 50
Reese, Graff & Woods.....Pittsburgh, Pa..... " 68

Stencils.

Mathiesen & Schrader.....New York.....See Page 82
W. W. Wilcox.....Chicago, Ill..... " 190

Stereotype Metal.

Philadelphia Smelting Co.....Philadelphia, Pa.....See Page 134

Stone Masons' Tools.

Hermann Boker & Co.....New York.....See Pages 152, 154
Nelson Tool Works..... " " .....See Page 30

Stop Cocks.

R. A. Brick & Co.....New York.....See Page 48

Stove Boards.

Sidney Shepard & Co..... .....Buffalo, N. Y..... See Page 196

Stove Linings.

Philip Neukumet.....Philadelphia, Pa.....See Page 104
Star Fire Brick Co.....Pittsburgh, Pa..... " 232

Straightening Machines.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Street Cars.

McNairy & Clafien Manufacturing Co..... .....Cleveland, Ohio.....See Page 42

Submarine Telegraph Cables.

Bishop Gutta Percha Works.....New York.....See Page 34
Charles T. Chester..... " " ..... " 212

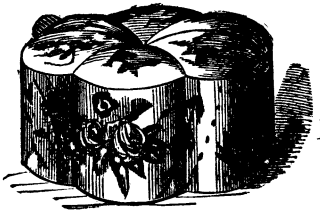
CIRCUMFERENCES AND AREAS OF CIRCLES—*Continued.*

Diam.	Circ.	Area.	Diam.	Circ.	Area.	Diam.	Circ.	Area.
88¼	277.2	6116.7	92½	290.5	6720.0	96¾	303.9	7351.7
	277.6	6134.0		290.9	6738.2		304.3	7370.7
88½	278.	6151.4	92¾	291.3	6756.4	97	304.7	7389.8
	278.4	6168.8		291.7	6776.4		305.1	7408.8
88¾	278.8	6186.2	93	292.1	6792.9	97¼	305.5	7427.9
	279.2	6203.6		292.5	6811.1		305.9	7447.0
89	279.6	6221.1	93¼	292.9	6829.4	97½	306.3	7466.2
	279.9	6238.6		293.3	6847.8		306.6	7485.3
89¼	280.3	6256.1	93½	293.7	6866.1	97¾	307.	7504.5
	280.7	6273.6		294.1	6884.5		307.4	7523.7
89½	281.1	6291.2	93¾	294.5	6902.9	98	307.8	7542.9
	281.5	6308.8		294.9	6921.3		308.2	7562.2
89¾	281.9	6326.4	94	295.3	6939.7	98¼	308.6	7581.5
	282.3	6344.0		295.7	6958.2		309.0	7600.8
90	282.7	6361.7	94¼	296.	6976.7	98½	309.4	7620.1
	283.1	6379.4		296.4	6995.2		309.8	7639.4
90¼	283.5	6397.1	94½	296.8	7013.8	98¾	310.2	7658.8
	283.9	6414.8		297.2	7032.3		310.6	7678.2
90½	284.3	6432.6	94¾	297.6	7050.9	99	311.0	7697.7
	284.7	6450.4		298.	7069.5		311.4	7717.1
90¾	285.1	6468.2	95	298.4	7088.2	99¼	311.8	7736.6
	285.4	6486.0		298.8	7106.9		312.1	7756.1
91	285.8	6503.8	95¼	299.2	7125.5	99½	312.5	7775.6
	286.2	6521.7		299.6	7144.3		312.9	7795.2
91¼	286.6	6539.6	95½	300.	7163.0	99¾	313.3	7814.7
	287.	6557.6		300.4	7181.8		313.7	7834.3
91½	287.4	6575.5	95¾	300.8	7200.5	100	314.1	7853.6
	287.8	6593.5		301.2	7219.4		314.5	7853.9
91¾	288.2	6611.5	96	301.5	7238.2	100¼	314.9	7893.3
	288.6	6629.5		301.9	7257.1		315.3	7913.1
92	289.	6647.6	96¼	302.3	7275.9	100½	315.7	7932.7
	289.4	6665.7		302.7	7294.9		316.0	7942.4
92¼	289.8	6683.8	96½	303.1	7313.8	100¾	316.4	7972.2
	290.2	6701.9		303.5	7332.8		316.8	7991.9

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

NEW YORK OTTOMAN AND HASSOCK CO.



PATENT

Ottomans and Hassocks

For Sleeping

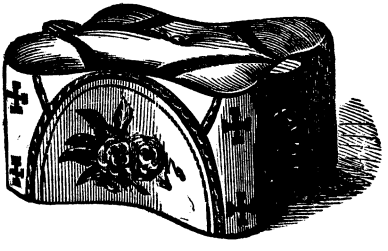
AND

Drawing-Room Cars.

PATENT

BOX

OTTOMANS.



32 Reade Street, New York.

ESTABLISHED 1858.

TRADE MARK, PATENTED.

Highest Premium Awarded by the American Institute Fair, 1871.

WASTE NO TIME, OIL OR LABOR ON WORTHLESS PAINTS.

USE PRINCE'S METALLIC PAINT,

Acknowledged throughout the United States to be the best fireproof, indestructible, and the cheapest to the consumer; one-third less oil and paint covers a greater surface than any other so-called Metallic Paint, Spanish Brown or Red Lead. ☞ A package containing 25 lbs. paint in oil, or 50 lbs. dry, will be sent to any Railroad Company free of charge, on application to us.

Send for a circular containing testimonials from the principal Railroad Companies, Manufacturers, and others in the country. For sale by the trade generally, and

PRINCE'S METALLIC PAINT CO.,

96 CEDAR STREET, NEW YORK.

☞All Packages are marked with name and trade-mark.☜

Hosted by Google

Subterranean Telegraph Wires.

Bishop Gutta Percha Works.....New York.....See Page 34
Charles T. Chester..... " " ..... " 212

Surveying Instruments.

F. Eckel.....New York.....See Page 76
Kuebler & Seelhorst.....Philadelphia, Pa..... " 216
Wm. J. Young & Son..... " " ..... " 138

Switches.

O. W. Child.....New York.....See Page 262
Pittsburgh Bolt Co.....Pittsburgh, Pa..... " 118
Skinner & Gifford Manufacturing Co.....Dunkirk, N. Y..... " 140
The Atlas Works.....Pittsburgh, Pa..... " 172
The Wharton R. R. Switch Co.....Philadelphia, Pa..... " 222

Switch Lights.

Parmelee & Bonnell.....Buffalo, N. Y.....See Page 202
S. M. Aikman & Co.....New York..... " 114

Switch Locks.

Romer & Co., *Patentees and Manufacturers*.....Newark, N. J.....See Page 204

Syphons.

Leng & Ogden.....New York.....See next page to back.

Tacks, Brads, &c.

G. B. Walbridge.....New York.....See Page 130

Tallow.

De Grauw, Aymar & Co.....New York.....See Page 112
Isaac U. Coles..... " " ..... " 20

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS.

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
1	1	1	1.0	1.0	31	961	29791	5.567	3.141
2	4	8	1.414	1.259	32	1024	32768	5.656	3.174
3	9	27	1.732	1.442	33	1089	35937	5.744	3.207
4	16	64	2.0	1.587	34	1156	39304	5.830	3.239
5	25	125	2.230	1.709	35	1225	42875	5.916	3.271
6	36	216	2.449	1.817	36	1296	46656	6.0	3.301
7	49	343	2.645	1.912	37	1369	50653	6.082	3.332
8	64	512	2.828	2.0	38	1444	54872	6.164	3.361
9	81	729	3.0	2.080	39	1521	59319	6.245	3.391
10	100	1000	3.162	2.154	40	1600	64000	6.324	3.419
11	121	1331	3.316	2.223	41	1681	68921	6.403	3.448
12	144	1728	3.464	2.289	42	1764	74088	6.480	3.476
13	169	2197	3.605	2.351	43	1849	79507	6.557	3.503
14	196	2744	3.741	2.410	44	1936	85184	6.633	3.530
15	225	3375	3.872	2.466	45	2025	91125	6.708	3.556
16	256	4096	4.0	2.519	46	2116	97336	6.782	3.583
17	289	4913	4.123	2.571	47	2209	103823	6.855	3.608
18	324	5832	4.242	2.620	48	2304	110592	6.928	3.634
19	361	6859	4.358	2.668	49	2401	117649	7.0	3.659
20	400	8000	4.472	2.714	50	2500	125000	7.071	3.684
21	441	9261	4.582	2.758	51	2601	132651	7.141	3.708
22	484	10648	4.690	2.802	52	2704	140608	7.211	3.732
23	529	12167	4.795	2.843	53	2809	148877	7.280	3.756
24	576	13824	4.898	2.884	54	2916	157464	7.348	3.779
25	625	15625	5.0	2.924	55	3025	166375	7.416	3.802
26	676	17576	5.099	2.962	56	3136	175616	7.483	3.825
27	729	19683	5.196	3.0	57	3249	185193	7.549	3.848
28	784	21952	5.291	3.036	58	3364	195112	7.615	3.870
29	841	24389	5.385	3.072	59	3481	205379	7.681	3.893
30	900	27000	5.477	3.107	60	3600	216000	7.745	3.914

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

THE

ATLANTIC WHITE LEAD

AND

LINSEED OIL COMPANY,

CRUSHERS OF

Linseed Oil,

Raw, Refined or Boiled.

TRADE MARK.

Robert Colgate & Co.,

287 Pearl Street,

NEW YORK.

Hosted by Google

Tallow Cans and Cups.

J. G. Knapp Manufacturing Co.....New York.....See Page 16
Pancoast & Maule.....Philadelphia, Pa..... " 26

Tallow Lubricator.

Isaac U. Coles.....New York.....See Page 20

Tank Iron.

J. T. Ryerson.....Chicago, Ill.....See Page 180

Tanks.

Joseph Churchyard.....Buffalo, N. Y.....See Page 160

Tank Valves.

Hart, Ball & Hart.....Buffalo, N. Y.....See Page 136
Skinner & Gifford Manufacturing Co.....Dunkirk, N. Y..... " 140

Taps.

Champlin & Rogers.....Chicago, Ill.....See Page 192
Providence Tool Co.; H. B. Newhall, Agent.....New York..... " 166
The Worcester Machine Screw Co.; H. B. Newhall, Agent..... " " ..... " 166

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
61	3721	226981	7.810	3.936	91	8281	753571	9.539	4.497
62	3844	238328	7.874	3.957	92	8464	778688	9.591	4.514
63	3969	250047	7.937	3.979	93	8649	804357	9.643	4.539
64	4096	262144	8.0	4.0	94	8836	830584	9.695	4.546
65	4225	274625	8.062	4.020	95	9025	857375	9.746	4.562
66	4356	287496	8.124	4.041	96	9216	884736	9.797	4.578
67	4489	300763	8.185	4.061	97	9409	912673	9.848	4.594
68	4624	314432	8.246	4.081	98	9604	941192	9.899	4.610
69	4761	328509	8.306	4.101	99	9801	970299	9.949	4.626
70	4900	343000	8.366	4.121	100	10000	1000000	10.0	4.641
71	5041	357911	8.426	4.140	101	10201	1030301	10.049	4.657
72	5184	373248	8.485	4.160	102	10404	1061208	10.099	4.672
73	5329	389017	8.544	4.179	103	10609	1092727	10.148	4.687
74	5476	405224	8.602	4.198	104	10816	1124864	10.198	4.702
75	5625	421875	8.660	4.217	105	11025	1157625	10.246	4.717
76	5776	438976	8.717	4.235	106	11236	1191016	10.295	4.732
77	5929	456533	8.774	4.254	107	11449	1225043	10.344	4.747
78	6084	474552	8.831	4.272	108	11664	1259712	10.392	4.762
79	6241	493039	8.888	4.290	109	11881	1295029	10.440	4.776
80	6400	512000	8.944	4.308	110	12100	1331000	10.488	4.791
81	6561	531441	9.0	4.326	111	12321	1367631	10.535	4.805
82	6724	551368	9.055	4.344	112	12544	1404928	10.583	4.820
83	6889	571787	9.110	4.362	113	12769	1442897	10.630	4.834
84	7056	592704	9.165	4.379	114	12996	1481544	10.677	4.848
85	7225	614125	9.219	4.396	115	13225	1520875	10.723	4.862
86	7396	636056	9.273	4.414	116	13456	1560896	10.770	4.877
87	7569	658503	9.327	4.431	117	13689	1601613	10.816	4.890
88	7744	681472	9.380	4.447	118	13924	1643032	10.862	4.904
89	7921	704969	9.433	4.464	119	14161	1685159	10.908	4.918
90	8100	729000	9.486	4.481	120	14400	1728000	10.954	4.932

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

THE

Atlantic White Lead

AND

LINSEED OIL COMPANY,

MANUFACTURERS OF

WHITE LEAD,

DRY AND IN OIL.

RED LEAD,

AND

PAINTERS' AND GLASS MAKERS'

LITHARGE.

CRUSHERS OF LINSEED OIL.

TRADE MARK.

Robert Colgate & Co.,

287 Pearl Street,

NEW YORK.

Hosted by Google

Telegraph Apparatus.

Charles T. Chester	New York	See Page 212
F. L. Pope & Co	" "	" 184
Geo. H. Crain & Co	Chicago, Ill	" 124
Geo. H. Bliss & Co	" "	" 164
Leclanche Battery Co	New York	" 96
L. G. Tillotson & Co	" "	" 94
M. A. Buell	Cleveland, Ohio	" 46
Merchants Manufacturing & Construction Co	New York	" 18
Mathiesen & Schrader	" "	" 82
Towle & Unger Manufacturing Co	" "	" 186
Vose, Dinsmore & Co	" "	" 60

Telegraph Batteries.

See Telegraph Apparatus.

Telegraph Builders.

Charles T. Chester	New York	See Page 212
Merchants Manufacturing & Construction Co	" "	" 18

Telegraph Instruments and Fixtures.

See Telegraph Apparatus.

Telegraph Material.

Charles T. Chester	New York	See Page 212
F. L. Pope & Co	" "	" 184
Geo. H Bliss & Co	Chicago, Ill	" 164
Leclanche Battery Co	New York	" 96
L. G. Tillotson & Co	" "	" 94
M. A. Buell	Cleveland, Ohio	" 46
Merchants Manufacturing & Construction Co.	New York	" 18

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
121	14641	1771561	11.0	4.946	151	22801	3442951	12.288	5.325
122	14884	1815848	11.045	4.959	152	23104	3511008	12.328	5.336
123	15129	1860867	11.090	4.973	153	23409	3581577	12.369	5.348
124	15376	1906624	11.135	4.986	154	23716	3652264	12.409	5.360
125	15625	1953125	11.180	5.0	155	24025	3723875	12.449	5.371
126	15876	2000376	11.224	5.013	156	24336	3796416	12.490	5.383
127	16129	2048383	11.269	5.026	157	24649	3869893	12.529	5.394
128	16384	2097152	11.313	5.039	158	24964	3944312	12.569	5.406
129	16641	2146689	11.357	5.052	159	25281	4019679	12.609	5.417
130	16900	2197000	11.401	5.065	160	25600	4096000	12.649	5.428
131	17161	2248091	11.445	5.078	161	25921	4173281	12.688	5.440
132	17424	2299968	11.489	5.091	162	26244	4251528	12.727	5.451
133	17689	2352637	11.532	5.104	163	26569	4330747	12.767	5.462
134	17956	2406104	11.575	5.117	164	26896	4410944	12.806	5.473
135	18225	2460375	11.618	5.129	165	27225	4492125	12.845	5.484
136	18496	2515456	11.661	5.142	166	27556	4574296	12.884	5.495
137	18769	2571353	11.704	5.155	167	27889	4657463	12.922	5.506
138	19044	2628072	11.747	5.167	168	28224	4741632	12.961	5.517
139	19321	2685619	11.789	5.180	169	28561	4826809	13.0	5.528
140	19600	2744000	11.832	5.192	170	28900	4913000	13.038	5.539
141	19881	2803221	11.874	5.204	171	29241	5000211	13.076	5.550
142	20164	2863288	11.916	5.217	172	29584	5088448	13.114	5.561
143	20449	2924207	11.958	5.229	173	29929	5177717	13.152	5.572
144	20736	2985984	12.0	5.241	174	30276	5268024	13.190	5.582
145	21025	3048625	12.041	5.253	175	30625	5359375	13.228	5.593
146	21316	3112136	12.083	5.265	176	30976	5451776	13.266	5.604
147	21609	3176523	12.124	5.277	177	31329	5545233	13.304	5.614
148	21904	3241792	12.165	5.289	178	31684	5639752	13.341	5.625
149	22201	3307949	12.206	5.301	179	32041	5735339	13.379	5.635
150	22500	3375000	12.247	5.313	180	32400	5832000	13.416	5.646

THIS TABLE IS TAKEN FROM "Hamilton's Useful Information for Railway Men," Published by D. VAN NOSTRAND, *For the Ramapo Wheel and Foundry Co.*

Hosted by Google

New York Plaster Works,

MANUFACTURERS OF

CALCINED AND LAND PLASTER,

MARBLE DUST, TERRA ALBA, &c., &c., &c

Our DOUBLE EXTRA PLASTER is *unsurpassed.* Every Barrel Warranted.

OUR QUARRIES ARE IN NOVA SCOTIA.

Foundry Facings and Supplies.

VAN TUYL M'F'G CO.

WORKS, 273 and 275 CHERRY STREET,

NEW YORK,

IMPORTERS AND MANUFACTURERS OF

LEADS, MINERALS, COALS,
FIRE BRICK, CRUCIBLES,
VITRIOL, WIRE BRUSHES,
MOULDERS' TOOLS,
SANDS and CLAYS,
BELLOWS, RIDDLES, &c.

— ALSO —

COVERINGS FOR BOILERS AND PIPES.

Superior Quality. ☞ First Prize American Institute Fair.

☞ SEND FOR PRICE LISTS. &c.

Hosted by Google

Telegraph Poles.

Geo. H. Crain & Co.....Chicago, Ill.....See Page 124
Geo. H. Bliss & Co..... " " ..... " 164

Telegraph Repairers' Tools.

Leclanche Battery Co.....New York.....See Page 96
See also, Telegraph Material.

Telegraph Wires.

Bishop Gutta Percha Works.....New York.....See Page 34
Chas. T. Chester..... " " ..... " 212
C. Thompson..... .....Philadelphia, Pa..... " 222
Geo. H. Bliss & Co.....Chicago, Ill..... " 164
Geo. H. Crain & Co..... " " ..... " 124
John Merry & Co.....New York..... " 48
Leclanche Battery Co..... " " ..... " 96
Marshall Lefferts, Jr..... " " ..... " 44
Tyng & Co..... " " ..... " 260

Tiles.

Maurer & Weber.....New York.....See Page 228
Philip Neukumet.....Philadelphia, Pa..... " 104
The Star Fire Brick Co.....Pittsburgh, Pa..... " 232

Timber.

Joseph Churchyard.....Buffalo, N. Y.....See Page 160

Tin—Pig.

Holmes & Lissberger.....New York.....See Page 84
Philadelphia Smelting Co.....Philadelphia, Pa..... " 134

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
181	32761	5929741	13.453	5.656	211	44521	9393931	14.525	5.953
182	33124	6028568	13.490	5.667	212	44944	9528128	14.560	5.962
183	33489	6128487	13.527	5.677	213	45369	9663597	14.594	5.972
184	33856	6229504	13.564	5.687	214	45796	9800344	14.628	5.981
185	34225	6331625	13.601	5.698	215	46225	9938375	14.662	5.990
186	34596	6434856	13.638	5.708	216	46656	10077696	14.696	6.0
187	34969	6539203	13.674	5.718	217	47089	10218313	14.730	6.009
188	35344	6644672	13.711	5.728	218	47524	10360232	14.764	6.018
189	35721	6751269	13.747	5.738	219	47961	10503459	14.798	6.027
190	36100	6859000	13.784	5.748	220	48400	10648000	14.832	6.036
191	36481	6967871	13.820	5.758	221	48841	10793861	14.866	6.045
192	36864	7077888	13.856	5.769	222	49284	10941048	14.899	6.055
193	37249	7189517	13.892	5.779	223	49729	11089567	14.933	6.064
194	37636	7301384	13.928	5.788	224	50176	11239424	14.966	6.073
195	38025	7414875	13.964	5.798	225	50625	11390625	15.0	6.082
196	38416	7529536	14.0	5.808	226	51076	11543176	15.033	6.099
197	38809	7645373	14.035	5.818	227	51529	11697083	15.066	6.100
198	39204	7762392	14.071	5.828	228	51984	11852352	15.099	6.109
199	39601	7880599	14.106	5.838	229	52441	12008989	15.132	6.118
200	40000	8000000	14.142	5.848	230	52900	12167000	15.165	6.126
201	40401	8120601	14.177	5.857	231	53361	12326391	15.198	6.135
202	40804	8242408	14.212	5.867	232	53824	12487168	15.231	6.144
203	41209	8365427	14.247	5.877	233	54289	12649337	15.264	6.153
204	41616	8489664	14.282	5.886	234	54756	12812904	15.297	6.162
205	42025	8615125	14.317	5.896	235	55225	12977875	15.329	6.171
206	42436	8741816	14.352	5.905	236	55696	13144256	15.362	6.179
207	42849	8869743	14.387	5.915	237	56169	13312053	15.394	6.188
208	43264	8998912	14.422	5.924	238	56644	13481272	15.427	6.197
209	43681	9129329	14.456	5.934	239	57121	13651919	15.459	6.205
210	44100	9261000	14.491	5.943	240	57600	13824000	15.491	6.214

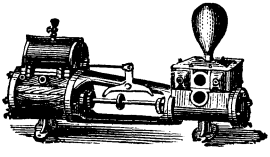
THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

THE SELDEN

DIRECT-ACTION

STEAM PUMP



Is the Best Steam Pump Made, Fully Guaranteed.

MONEY RETURNED IF NOT SATISFACTORY.

RAILWAY SUPPLIES,
PLUMBERS' SUPPLIES,
STEAM BOILERS, STEAM ENGINES,
STEAM GAUGES,
STEAM HOSE,
BELTING,
BOILER FLUES,
HEATING APPARATUS,
GAS and STEAM PIPE,
CONDENSORS,
LUBRICATORS,
HYDRANTS,
FITTINGS.

&c., &c., &c., &c.

A. CARR,

43 CORTLAND STREET, - NEW YORK.

☞ *SEND FOR ILLUSTRATED CATALOGUE.*

Hosted by Google

Tin and Coppersmiths' Solders.

Du Plaine & Reeves.....Philadelphia, Pa.....See Page 102
Philadelphia Smelting Co..... " " ..... " 134

Tin—Plate.

Bruce & Cook.....New York.....See Page 112
Tyng & Co..... " " ..... " 260
Wm. Green & Co.....Wilmington, Del..... " 248

Tinsmiths' Tools, &c.

Bruce & Cook.....New York.....See Page 112

Tin Ware.

Sidney Shepard & Co.....Buffalo, N. Y.....See Page 196

T Iron.

Rogers & Co.....Chicago, Ill.....See Page 144

Tool Builders.

Bolen, Crane & Co.....Newark, N. J.....See Page 62

Tool Handles.

G. B. Walbridge.....New York.....See Page 130

Tools.

Biddle Manufacturing Co.....New York.....See Page 12
Hermann Boker & Co..... " " .....See Pages 152, 154
Nelson Tool Works..... " " .....See Page 30
S. S. Townsend..... " " ..... " 2

Track Bolts.

Pittsburgh Forge & Iron Co.....Pittsburgh, Pa.....See Page 174
Pittsburgh Bolt Co..... " ..... " 118

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
241	58081	13997521	15.524	6.233	271	73441	19902511	16.462	6.471
242	58564	14172488	15.556	6.231	272	73984	20123648	16.492	6.479
243	59049	14348907	15.588	6.240	273	74529	20346417	16.522	6.487
244	59536	14526784	15.620	6.248	274	75076	20570824	16.552	6.495
245	60025	14706125	15.652	6.257	275	75625	20796875	16.583	6.502
246	60516	14886936	15.684	6.265	276	76176	21024576	16.613	6.510
247	61009	15069223	15.716	6.274	277	76729	21253933	16.643	6.518
248	61504	15252992	15.748	6.282	278	77284	21484952	16.678	6.526
249	62001	15438249	15.779	6.291	279	77841	21717639	16.703	6.534
250	62500	15625000	15.811	6.299	280	78400	21952000	16.733	6.542
251	63001	15813251	15.842	6.307	281	78961	22188041	16.763	6.549
252	63504	16003008	15.874	6.316	282	79524	22425768	16.792	6.557
253	64009	16194277	15.905	6.324	283	80089	22665187	16.822	6.565
254	64516	16387064	15.937	6.333	284	80656	22906304	16.852	6.573
255	65025	16581375	15.968	6.341	285	81225	23149125	16.881	6.580
256	65536	16777216	16.0	6.349	286	81796	23393656	16.911	6.588
257	66049	16974593	16.031	6.357	287	82369	23639903	16.941	6.596
258	66564	17173512	16.062	6.366	288	82944	23887872	16.970	6.603
259	67081	17373979	16.093	6.374	289	83521	24137569	17.0	6.611
260	67600	17576000	16.124	6.382	290	84100	24389000	17.029	6.619
261	68121	17779581	16.155	6.390	291	84681	24642171	17.058	6.626
262	68644	17984728	16.186	6.398	292	85264	24897088	17.088	6.634
263	69169	18191447	16.217	6.406	293	85849	25153757	17.117	6.641
264	69696	18399744	16.248	6.415	294	86436	25412184	17.146	6.649
265	70225	18609625	16.278	6.423	295	87025	25672375	17.175	6.656
266	70756	18821096	16.309	6.431	296	87616	25934836	17.204	6.664
267	71289	19034163	16.340	6.439	297	88209	26198073	17.233	6.671
268	71824	19248832	16.370	6.447	298	88804	26463592	17.262	6.678
269	72361	19465109	16.401	6.455	299	89401	26730899	17.291	6.686
270	72900	19683000	16.431	6.463	300	90000	27000000	17.320	6.694

THIS TABLE IS TAKEN FROM "Hamilton's Useful Information for Railway Men," Published by D. VAN NOSTRAND, *For the Ramapo Wheel and Foundry Co.*

Hosted by Google

BREWERS

WROUGHT IRON

Builders' Hardware Co.

MANUFACTURERS OF

Hinges, Hinge Nails, Wagon Bow Staples, Hasps, Chute Nails, Hinge Rivets, Rings, Sheathe Nails, Cold Chisels, Staples, Open Links, Hooks and Staples, Stay Nails, Corner Braces, &c., &c.

ALL WORK FIRST-CLASS. TINNED GOODS A SPECIALTY.

ALSO, PRINCIPAL DEPOT FOR

Emery Goods, Emery Machinery and Union Emery Wheels,

OF ALL DESCRIPTIONS.

Machine Knife Grinders, Lathe Centre Grinders, &c.
Morse's Patent Twist Drills and Drill Chucks.
Peerless Washing Machine and Boiler & Stove.

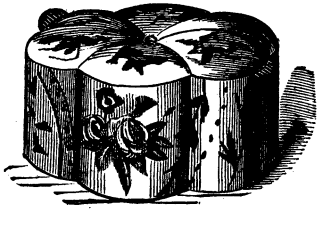
Office and Salesroom, 502 Commerce St., PHILADELPHIA.

GEORGE DRAKE SMITH,

MANUFACTURER OF

OTTOMANS AND HASSOCKS,

FOR DRAWING ROOM AND SLEEPING CARS.



223 CHURCH STREET, PHILADELPHIA.

J. M. COPPERNOLL,

Agent for New York, 298 Broadway.

Hosted by Google

Track Layers' Tools.

Nelson Tool Works.....New York.....See Page 30

Track Supplies.

Greene & Randolph.....New York.....See Page 54

T Rails.

Jones & Laughlins.....Pittsburgh, Pa.....See Page 32
8, 12, 16, 20, 28, 40 lbs. to Yard.
Reese, Graff & Woods.....Pittsburgh, Pa.....See Page 68
12, 16, 20, 28 and 34 lbs. to Yard.

Transits.

F. Eckel.....New York.....See Page 76
Kuebler & Seelhorst.....Philadelphia, Pa.....“ 216
Wm. J. Young & Son.....“ “ .....“ 138

Transfer Tables.

McNairy & Claflen Manufacturing Co.....Cleveland, Ohio.....See Page 42
Skinner & Gifford Manufacturing Co.....Dunkirk, N. Y.....“ 140
Snyder Bros.....Williamsport, Pa.....“ 46
Wm. Sellers & Co.....Philadelphia, Pa.....“ 64

Transportation Cars.

Orrin L. Gridley.....Buffalo, N. Y.....See Page 196
Sidney Shepard & Co.....“ .....“ 196

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
301	90601	27270901	17.349	6.701	331	109561	36264691	18.193	6.917
302	91204	27543608	17.378	6.709	332	110224	36594368	18.220	6.924
303	91809	27818127	17.406	6.716	333	110889	36926037	18.248	6.931
304	92416	28094464	17.435	6.723	334	111556	37259704	18.275	6.938
305	93025	28372625	17.464	6.731	335	112225	37595375	18.303	6.945
306	93636	28652616	17.492	6.738	336	112896	37933056	18.330	6.952
307	94249	28934443	17.521	6.745	337	113569	38272753	18.357	6.958
308	94864	29218112	17.549	6.753	338	114244	38614472	18.384	6.965
309	95481	29503609	17.578	6.760	339	114921	38958219	18.411	6.972
310	96100	29791000	17.606	6.767	340	115600	39304000	18.439	6.979
311	96721	30080231	17.635	6.775	341	116281	39651821	18.466	6.986
312	97344	30371328	17.663	6.782	342	116964	40001688	18.493	6.993
313	97969	30664297	17.691	6.789	343	117649	40353607	18.520	7.0
314	98596	30959144	17.720	6.796	344	118336	40707584	18.547	7.006
315	99225	31255875	17.748	6.804	345	119025	41063625	18.574	7.013
316	99856	31554496	17.776	6.811	346	119716	41421736	18.601	7.020
317	100489	31855013	17.804	6.818	347	120409	41781923	18 627	7.027
318	101124	32157432	17.832	6.825	348	121104	42144192	18.654	7.033
319	101761	32461759	17.860	6.832	349	121801	42508549	18.681	7.040
320	102400	32768000	17.888	6.839	350	122500	42875000	18.708	7.047
321	103041	33076161	17.916	6.847	351	123201	43243551	18.734	7.054
322	103684	33386248	17.944	6.854	352	123904	43614208	18.761	7.060
323	104329	33698267	17.972	6.861	353	124609	43986977	18.788	7.067
324	104976	34012224	18.0	6 868	354	125316	44361864	18.814	7.074
325	105625	34328125	18.027	6.875	355	126025	44738875	18.841	7 080
326	106276	34645976	18.055	6.882	356	126736	45118016	18.867	7.087
327	106929	34965783	18.083	6.889	357	127449	45499293	18.894	7 093
328	107584	35287552	18.110	6.896	358	128164	45882712	18.920	7.100
329	108241	35611289	18.138	6.903	359	128881	46268279	18.947	7.107
330	108900	35937000	18.165	6.910	360	129600	46656000	18.973	7.113

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

ESTABLISHED - - - - 1816.

WILLIAM GREEN & CO.

Manufacturers' Agents,

IMPORTERS and WHOLESALE DEALERS IN

Iron, Steel, Tin Plates,

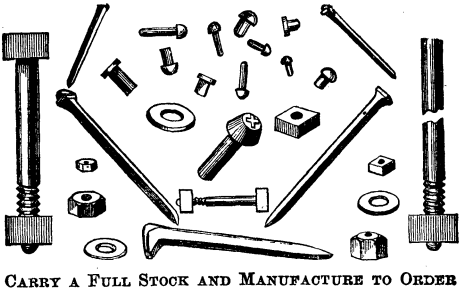
AND

CARRIAGE GOODS.

Corner Third and Shipley Sts.,

WILMINGTON, DELAWARE.

Baltimore Rivet and Spike Works



CARRY A FULL STOCK AND MANUFACTURE TO ORDER

RIVETS, SPIKES, BOLTS,
NUTS, WASHERS, BOLT ENDS.

WM. GILMOR of WM.

Cor. President and Fawn Sts., BALTIMORE, Md.

Hosted by Google

Trucks.

A. M. Gilbert & Co.....Chicago, Ill.....See Page 180
W. A. Dobinson & Co.....Buffalo, N. Y..... " 196

Tube Expanders.

R. Dudgeon.....New York.....See Page 70

Tubing—Brass and Copper.

Ansonia Brass & Copper Co.....New York.....See Page 122

Turn Buckles.

Providence Tool Co.; H. B. Newhall, Agent....New York.....See Page 166

Turning Machines.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64
Wm. B. Bement & Son.....Philadelphia, Pa..... " 168
See also, Iron Working Machinery and Wood Working Machinery.

Turn Tables.

O. W. Child.....New York.....See Page 262
McNairy & Claflen Manufacturing Co.....Cleveland, Ohio..... " 42
Skinner & Gifford Manufacturing Co.....Dunkirk, N. Y..... " 140
Snyder Bros.....Williamsport, Pa..... " 46
Wm. Sellers & Co.....Philadelphia, Pa..... " 64

Twist Drills.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
361	130321	47045881	19.0	7.120	391	152881	59776471	19.773	7.312
362	131044	47437928	19.026	7.126	392	153664	60236288	19.798	7.318
363	131769	47832147	19.052	7.133	393	154449	60698457	19.824	7.324
364	132496	48228544	19.078	7.140	394	155236	61162984	19.849	7.331
365	133225	48627125	19.104	7.146	395	156025	61629875	19.874	7.337
366	133956	49027896	19.131	7.153	396	156816	62099136	19.899	7.343
367	134689	49430863	19.157	7.159	397	157609	62570773	19.924	7.349
368	135424	49836032	19.183	7.166	398	158404	63044792	19.949	7.355
369	136161	50243409	19.209	7.172	399	159201	63521199	19.974	7.361
370	136900	50653000	19.235	7.179	400	160000	64000000	20.0	7.368
371	137641	51064811	19.261	7.185	401	160801	64481201	20.024	7.374
372	138384	51478848	19.287	7.191	402	161604	64964808	20.049	7.380
373	139129	51895117	19.313	7.198	403	162409	65450827	20.074	7.386
374	139876	52313624	19.339	7.204	404	163216	65939264	20.099	7.392
375	140625	52734375	19.364	7.211	405	164025	66430125	20.124	7.398
376	141376	53157376	19.390	7.217	406	164836	66923416	20.149	7.404
377	142129	53582633	19.416	7.224	407	165649	67419.43	20.174	7.410
378	142884	54010152	19.442	7.230	408	166464	67917312	20.199	7.416
379	143641	54439939	19.467	7.236	409	167281	68417929	20.223	7.422
380	144400	54872000	19.493	7.243	410	168100	68921000	20.248	7.428
381	145161	55306341	19.519	7.249	411	168921	69426531	20.273	7.434
382	145924	55742968	19.544	7.255	412	169744	69934528	20.297	7.441
383	146689	56181887	19.570	7.262	413	170569	70444997	20.322	7.447
384	147456	56623104	19.595	7.268	414	171396	70957944	20.346	7.453
385	148225	57066625	19.621	7.274	415	172225	71473375	20.371	7.459
386	148996	57512456	19.646	7.281	416	173056	71991296	20.396	7.465
387	149769	57960603	19.672	7.287	417	173889	72511713	20.420	7.471
388	150544	58411072	19.697	7.293	418	174724	73034632	20.445	7.476
389	151321	58863869	19.723	7.299	419	175561	73560059	20.469	7.482
390	152100	59319000	19.748	7.306	420	176400	74088000	20.493	7.488

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Kinnapo Wheel and Foundry Co.

Hosted by Google

RADLEY & McALISTER MANF'G CO.

MANUFACTURERS OF

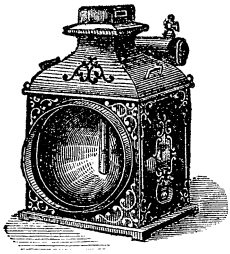
GAS, KEROSENE AND SPERM OIL

HEAD LIGHTS.

Also of James Radley's New and Improved

SPARK ARRESTER,

AND THE WELL-KNOWN RADLEY & HUNTER PIPE.



GAS HEAD LIGHT.

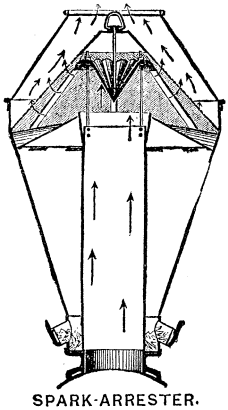
62 John St., New York.

Our GAS HEAD LIGHT has now been in use over 4 years, and with entire satisfaction, on 40 of our first-class Railroads, and has demonstrated its superiorty over all others for **Simplicity, Durability, Economy** and great **Brilliancy** of light. Old Kerosene Head Lights altered at small cost. Our **Kerosene** Head Lights are of new patterns. We make 4 sizes· 23 inch, 21 inch, 18 inch and 16 inch.

JAMES RADLEY'S NEW AND IMPROVED SPARK-ARRESTER,

ANSWERS EITHER FOR

WOOD OR COAL BURNING ENGINES.



SPARK-ARRESTER.

A large number have been running for a year past on Engines of the *Baltimore and Ohio, Galveston, Houston and Henderson, Galveston, Houston and San Antonio, Houston and Great Northern,* and more recently on the *Louisville and Nashville Railroads.* The Pipe has proved itself the most perfect Spark Arrester known: 1st—As perfectly safe from throwing fire; 2d—The escaping smoke and steam are driven out with great force above the top of the cars and clear of the train, thus keeping the cars free from cinders and smoke; 3d—Its steaming qualities cannot be excelled. By reference to the Cut, it will be seen that the area of the opening of the wire cloth is more than three times that of the opening at the top of the pipe, thus insuring a freer exhaust than in other pipes. For further particulars please send for Circulars.

(Factory, 13 Vine St., Brooklyn, New York.)

Hosted by Google

Twist Drill Grinders.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Twisted Hooks.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Type Metal.

Philadelphia Smelting Co.....Philadelphia, Pa.....See Page 134

Tyres.

Jno. A. Griswold & Co.....Troy, N. Y.....See Page 50
L. G. Tillotson & Co.....New York..... " 94
Miller & Smith..... " " ..... " 112
Posts & Kalkman.....New York..... " 266
Schenectady Locomotive Works.....Schenectady, N. Y..... " 148
Vose, Dinsmore & Co.....New York..... " 60

Universal Drills.

Wm. Sellers & Co.....Philadelphia, Pa.....See Page 64

Urinals.

A. Carr.....New York.....See Page 244
L. G. Tillotson & Co..... " " ..... " 94
Vose, Dinsmore & Co..... " " ..... " 60

Vacuum Gauges.

A. Carr.....New York.....See Page 244
Buffalo Steam Gauge Co.....Buffalo, N. Y..... " 170
Geo. W. Richardson & Co.....Troy, N. Y..... " 50
J. G. Knapp Madufacturing Co.....New York..... " 16
McNab & Harlin Manufacturing Co.....New York..... " 220
Tyng & Co..... " " ..... " 260
Vose, Dinsmore & Co..... " " ..... " 60

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
421	177241	74618461	20.518	7.494	451	203401	91733851	21.236	7.668
422	178084	75151448	20.542	7.500	452	204304	92345408	21.260	7.674
423	178929	75686967	20.566	7.506	453	205209	92959677	21.283	7.680
424	179776	76225024	20.591	7.512	454	206116	93576664	21.307	7.685
425	180625	76765625	20.615	7.518	455	207025	94196375	21.330	7.691
426	181476	77308776	20.639	7.524	456	207936	94818816	21.354	7.697
427	182329	77854483	20.663	7.530	457	208849	95443993	21.377	7.702
428	183184	78402752	20.688	7.536	458	209764	96071912	21 400	7.708
429	184041	78953589	20.712	7.541	459	210681	96702579	21.424	7.713
430	184900	79507000	20 736	7.547	460	211600	97336000	21.447	7.719
431	185761	80062991	20.760	7.553	461	212521	97972181	21.470	7.725
432	186624	80621568	20.784	7.559	462	213444	98611128	21.494	7.730
433	187489	81182737	20.808	7.565	463	214369	99252847	21.517	7.736
434	188356	81746504	20.832	7.571	464	215296	99897344	21.540	7.741
435	189225	82312875	20.856	7.576	465	216225	100544625	21.563	7.747
436	190096	82881856	20.880	7.582	466	217156	101194696	21 587	7.752
437	190969	83453453	20.904	7 588	467	218089	101847563	21.610	7.758
438	191844	84027672	20.928	7.594	468	219024	102503232	21.633	7.763
439	192721	84604519	20.952	7.600	469	219961	103161709	21.656	7.769
440	193600	85184000	20.976	7.605	470	220900	103823000	21.679	7.774
441	194481	85766121	21.0	7.611	471	221841	104487111	21.702	7.780
442	195364	86350888	21.023	7.617	472	222784	105154048	21.725	7.785
443	196249	86938307	21.047	7.623	473	223729	105828817	21.748	7.791
444	197136	87528384	21.071	7.628	474	224676	106496424	21.771	7.796
445	198025	88121125	21.095	7.634	475	225625	107171875	21.794	7.802
446	198916	88716536	21.118	7.640	476	226576	107850176	21.817	7.807
447	199809	89314623	21.142	7.646	477	227529	108531333	21.840	7.813
448	200704	89915392	21.166	7.651	478	228484	109215352	21.863	7.818
449	201601	90518849	21.189	7.657	479	229441	109902239	21.886	7.824
450	202500	91125000	21.213	7.663	480	230400	110592000	21.908	7.829

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

ESTABLISHED 1844.

GEO. M. ALLERTON, PRES'T. ROBT. S. WALKER, SEC'Y.
R G. ALLERTON, TREAS. J. D. VERMEUL, VICE-PRES.

GOODYEAR'S

INDIA RUBBER GLOVE MANUF'G CO.

205 Broadway, 162, 164 & 166 Fulton St.,

(Factories, Naugatuck, Conn.) NEW YORK.

"FIRST HANDS" IN

RUBBER GOODS.

OFFICE SUPPLIES,
BELTING, PACKING, HOSE,
CLOTHING, BOOTS AND SHOES,
SUBMARINE ARMOR, BUOYS,
PONTOONS, LIFE BOATS,
AND

EVERY DESCRIPTION OF RUBBER GOODS

FOR

RAILWAYS AND STEAMSHIPS.

SEND FOR CATALOGUE AND PRICE LIST.

Hosted by Google

Vacuum Pumps.

J. B. Waring.....New York.....See Page 24

Valve Oil.

F. S. Pease.....Buffalo, N. Y.....See Page 100

Valves.

A. Fulton's Son & Co.....Pittsburgh, Pa.....See Page 116
Crane Bros. Manufacturing Co.....Chicago, Ill..... " 230
Geo. W. Richardson & Co.....Troy, N. Y..... " 50
J. D. West & Co.....New York..... " 56
J. J. Walworth.....Chicago, Ill..... " 124
Morris, Tasker & Co.....Philadelphia, Pa..... " 36
R. A. Brick & Co.....New York..... " 48

Vanes.

J. D. West & Co.....New York.....See Page 56

Varnish.

Edward Smith & Co.....New York.....See Page 218
H. W. Johns..... " " ..... " 224
Jay & Cook..... " " ..... " 234
J. W. Masury & Son..... " " ..... " 214
Valentine & Co..... " " ..... " 198

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
481	231361	111284641	21.931	7.835	511	261121	133432831	22.605	7.994
482	232324	111980168	21.954	7.840	512	262144	134217728	22.627	8.0
483	233289	112678587	21.977	7.846	513	263169	135005697	22.649	8.005
484	234256	113379904	22.0	7.851	514	264196	135796744	22.671	8.010
485	235225	114084125	22.022	7.856	515	265225	136590875	22.693	8.015
486	236196	114791256	22.045	7.862	516	266256	137388096	22.715	8.020
487	237169	115501303	22.068	7.867	517	267289	138188413	22.737	8.025
488	238144	116214272	22.090	7.872	518	268324	138991832	22.759	8.031
489	239121	116930169	22.113	7.878	519	269361	139798359	22.781	8.036
490	240100	117649000	22.135	7.883	520	270400	140608000	22.803	8.041
491	241081	118370771	22.158	7.889	521	271441	141420761	22.825	8.046
492	242064	119095488	22.181	7.894	522	272484	142236648	22.847	8.051
493	243049	119823157	22.203	7.899	523	273529	143055667	22.869	8.056
494	244036	120553784	22.226	7.905	524	274576	143877824	22.891	8.062
495	245025	121287375	22.248	7.910	525	275625	144703125	22.912	8.067
496	246016	122023936	22.271	7.915	526	276676	145531576	22.934	8.072
497	247009	122763473	22.293	7.921	527	277729	146363183	22.956	8.077
498	248004	123505992	22.315	7.926	528	278784	147197952	22.978	8.082
499	249001	124251499	22.338	7.931	529	279841	148035889	23.0	8.087
500	250000	125000000	22.360	7.937	530	280900	148877000	23.021	8.092
501	251001	125751501	22.383	7.942	531	281961	149721291	23.043	8.097
502	252004	126506008	22.405	7.947	532	283024	150568768	23.065	8.102
503	253009	127263527	22.427	7.952	533	284089	151419437	23.086	8.107
504	254016	128024064	22.449	7.958	534	285156	152273304	23.108	8.112
505	255025	128787625	22.472	7.963	535	286225	153130375	23.130	8.118
506	256036	129554216	22.494	7.968	536	287296	153990656	23.151	8.128
507	257049	130323843	22.516	7.973	537	288369	154854153	23.173	8 128
508	258064	131096512	22.538	7.979	538	289444	155720872	23.194	8.133
509	259081	131872229	22.561	7.984	539	290521	156590819	23.216	8.138
510	260100	132651000	22.583	7.989	540	291600	157464000	23.237	8.143

THIS TABLE IS TAKEN FROM "Hamilton's Useful Information for Railway Men," Published by D. VAN NOSTRAND, *For the Ramapo Wheel and Foundry Co.*

Hosted by Google

HALL AND SONS'

BUFFALO FIRE BRICK WORKS,

BUFFALO, NEW YORK.

FIRE BRICKS

OF THE BEST QUALITY FOR ALL PURPOSES,

MANUFACTURED OF THE

Best New Jersey Clays,

FROM OUR OWN MINES.

SPECIAL ATTENTION GIVEN TO ORDERS FOR

LOCOMOTIVE BRICK, ALSO CUPOLAS FOR IRON OR BRASS

N. H. GARDNER & CO.

TANNERS and MANUFACTURERS OF

OAK LEATHER BELTING

AND DEALERS IN

Lace Leather.

Office, 129 Washington St., Tannery, 852 Seneca St.,

BUFFALO, N. Y.

☞ALL GOODS WARRANTED AND SATISFACTION GUARANTEED.

Hosted by Google

Ventilators.

Radley & McAlister Manufacturing Co.....New York.....See Page 250
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138

Vises.

Champlin & Rogers.....Chicago, Ill.....See Page 192
England & Bindley.....Pittsburgh, Pa..... " 162
Hermann Boker & Co. .....New York.....See Pages 152, 154
J. J. Walworlh..... .....Chicago, Ill.....See Page 124

Washers.

G. B. Walbridge.....New York..... .....See Page 130
Hoo es & Townsend.....Philadelphia, Pa..... " 28
Lewis Oliver & Phillips; H. B. Newhall, Ag't...New York..... " 166
Pittsburgh Bolt Co..... .....Pittsburgh, Pa..... " 118
Pratt & Co.....Buffalo, N. Y..... " 132
Providence Tool Co.; H. B. Newhall, Agent....New York..... " 166
The Reading Bolt & Nut Works; H. B. Newhall, Agent..... " " ..... " 166
Wm. Green & Co.....Wilmington, Del..... " 248
Wm. Gilmor of Wm.....Baltimore, Md..... ..... " 248
Wm. H. Haskell & Co.; H. B. Newhall, Ag't....New York..... " 166

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
541	292681	158340421	23.259	8.148	571	326041	186169411	23.895	8.296
542	293764	159220088	23.280	8.153	572	327184	187149248	23.916	8.301
543	294849	160103007	23.302	8.158	573	328329	188132517	23.937	8.305
544	295936	160989184	23.323	8.163	574	329476	189119224	23.958	8.310
545	297025	161878625	23.345	8.168	575	330625	190109375	23.979	8.315
546	298116	162771336	23.366	8.173	576	331776	191102976	24.0	8.320
547	299209	163667323	23.388	8.178	577	332929	192100033	24.020	8.325
548	300304	164566592	23.409	8.183	578	334084	193100552	24.041	8.329
549	301401	165469149	23.430	8.188	579	335241	194104539	24.062	8.334
550	302500	166375000	23.452	8.193	580	336400	195112000	24.083	8.339
551	303601	167284151	23.473	8.198	581	337561	196122941	24.103	8.344
552	304704	168196608	23.494	8.203	582	338724	197137368	24.124	8.349
553	305809	169112377	23.515	8.208	583	339889	198155287	24.145	8.353
554	306916	170031464	23.537	8.213	584	341056	199176704	24.166	8.358
555	308025	170953875	23.558	8.217	585	342225	200201625	24.186	8.363
556	309136	171879616	23.579	8.222	586	343396	201230056	24.207	8.368
557	310249	172808693	23.600	8.227	587	344569	202262003	24.228	8.372
558	311364	173741112	23.622	8.232	588	345744	203297472	24.248	8.377
559	312481	174676879	23.643	8.237	589	346921	204336469	24.269	8.382
560	313600	175616000	23.664	8.242	590	348100	205379000	24.289	8.387
561	314721	176558481	23.685	8.247	591	349281	206425071	24.310	8.391
562	315844	177504328	23.706	8.252	592	350464	207474688	24.331	8.396
563	316969	178453547	23.727	8.257	593	351649	208527857	24.351	8.401
564	318096	179406144	23.748	8.262	594	352836	209584584	24.372	8.406
565	319225	180362125	23.769	8.267	595	354025	210644875	24.392	8.410
566	320356	181321496	23.790	8.271	596	355216	211708736	24.413	8.415
567	321489	182284263	23.811	8.276	597	356409	212776173	24.433	8.420
568	322624	183250432	23.832	8.281	598	357604	213847192	24.454	8.424
569	323761	184220009	23.853	8.286	599	358801	214921799	24.474	8.429
570	324900	185193000	23.874	8.291	600	360000	216000000	24.494	8.434

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

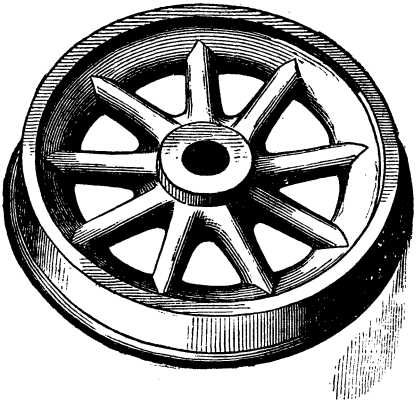
Hosted by Google

RAMAPO WHEEL AND FOUNDRY COMPANY,

GEO. CHURCH,
Pres't and Treas.

W. W. SNOW,
Sup't and General Manager.

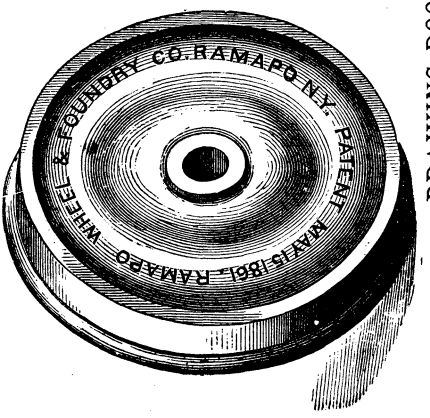
C. T. PIERSON,
Secretary.



MANUFACTURERS OF

WHEELS

FOR



DRAWING ROOM AND SLEEPING COACHES, TENDERS,
LOCOMOTIVES, PASSENGER AND FREIGHT CARS.

RAMAPO, Rockland County, NEW YORK.

Hosted by Google

Washing Machines.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Waste.

Phelps & Sanger.....Cleveland, Ohio.....See Page 120

SAW-MILL.

Gang Saw, 30 square feet of dry oak, or 45 square feet of dry pine, per hour, requires 1 horse-power.

Circular Saw, 2.5 feet in diameter, 270 revolutions per minute, 40 square feet of oak, or 70 of dry spruce, requires 1 horse-power.

300 revolutions per minute. 1.33 square feet of dry pine per minute, kerf 7-32 inch and 6 inches deep, requires the power of 1 horse for the saw alone; and 1 square feet, kerf ¼ inch and 1 foot in depth, requires a like power.

4.5 feet in diameter, kerf ¼, and 1 foot in depth, requires 1 horse-power for 1.33 feet per minute.

Oak requires nearly one-half more power than pine.

With a kerf of ⅛ inch, 1 horse-power will saw 2.66 square feet per minute.

The speed of the periphery should be about 50 feet per minute.

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
601	361201	217081801	24.515	8.439	631	398161	251239591	25.119	8.577
602	362404	218167208	24.535	8.443	632	399424	252435968	25.139	8.581
603	363609	219256227	24.556	8.448	633	400689	253636137	25.159	8.586
604	364816	220348864	24.576	8.453	634	401956	254840104	25.179	8.590
605	366025	221445125	24.596	8.457	635	403225	256047875	25.199	8.595
606	367236	222545016	24.617	8.462	636	404496	257259456	25.219	8.599
607	368449	223648543	24.637	8.467	637	405769	258474853	25.238	8.604
608	369664	224755712	24.657	8.471	638	407044	259694072	25.258	8.608
609	370881	225866529	24.677	8.476	639	408321	260917119	25.278	8.613
610	372100	226981000	24.698	8.480	640	409600	262144000	25.298	8.617
611	373321	228099131	24.718	8.485	641	410881	263374721	25.317	8.622
612	374544	229220928	24.738	8.490	642	412164	264609288	25.337	8.626
613	375769	230346397	24.758	8.494	643	413449	265847707	25.357	8.631
614	376996	231475544	24.779	8.499	644	414736	267089984	25.377	8.635
615	378225	232608375	24.799	8.504	645	416025	268336125	25.396	8.640
616	379456	233744896	24.819	8.508	646	417316	269585136	25.416	8.644
617	380689	234885113	24.839	8.513	647	418609	270840023	25.436	8.649
618	381924	236029032	24.859	8.517	648	419904	272097792	25.455	8.653
619	383161	237176659	24.879	8.522	649	421201	273359449	25.475	8.657
620	384400	238328000	24.899	8.527	650	422500	274625000	25.495	8.662
621	385641	239483061	24.919	8.531	651	423801	275894451	25.514	8.666
622	386884	240641848	24.939	8.536	652	425104	277167808	25.534	8.671
623	388129	241804367	24.959	8.540	653	426409	278445077	25.553	8.675
624	389376	242970624	24.979	8.545	654	427716	279726264	25.573	8.680
625	390625	244140625	25.0	8.549	655	429025	281011375	25.592	8.684
626	391876	245314376	25.019	8.554	656	430336	282300416	25.612	8.688
627	393129	246491883	25.039	8.558	657	431649	283593393	25.632	8.693
628	394384	247673152	25.059	8.563	658	432964	284890312	25.651	8.697
629	395641	248858189	25.079	8.568	659	434281	286191179	25.670	8.702
630	396900	250047000	25.099	8.572	660	435600	287496000	25.690	8.706

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

BOOKS FOR RAILROAD MEN.

SPECIAL NOTICE.—All of the Books from which extracts are made in this work, comprising *Haswell, Trautwine, Hamilton, Haslett, &c., &c.*, are for sale by me, and may be ordered by mail.

USEFUL INFORMATION FOR RAILROAD MEN.—Compiled by W. G. HAMILTON, Engineer. Fifth edition, revised and enlarged. 570 pages. Pocket form, Morocco gilt, $2.00.

"The 'Information' comprises some valuable formulæ and rules for the construction of boilers and engines, masonry, properties of steel and iron, and the strength of materials generally."

IRON TRUSS BRIDGES FOR RAILROADS.—The method of calculating strains in Trusses, with a careful comparison of the most prominent Trusses in reference to economy in combination, etc., etc. By Brevet-Colonel W. E. MERRILL, U.S.A., with nine lithographed plates of illustrations. 4to. cloth, $5.00.

A TREATISE ON THE STRENGTH OF BRIDGES AND ROOFS.—With practical applications and examples, for the use of Engineers and Students. By S. H. SHREVE, A.M.C.E. 346 pages, and 89 wood cuts. 8vo., tinted paper, cloth, $5.00.

THE THEORY OF STRAINS IN GIRDERS, and other similar structures, with Observations on the application of Theory to Practice, and Tables of strength and other properties of materials. By BINDON B. STONEY. New edition, revised and enlarged, and complete in one volume, with 5 plates and 123 wood cut illustrations. Royal 8vo., 660 pages, cloth, $15.00,

VAN NOSTRAND'S ECLECTIC ENGINEERING MAGAZINE, which commenced its Fifth Year, January, 1873, is admirably adapted to meet the wants, not only of Engineers, but of all who are interested in Scientific subjects. It presents in a convenient form the best articles, (with their illustrations,) selected from European and American Scientific Journals, together with Original Papers from leading scientists of our times.

Issued Monthly, at $5.00 per Annum in Advance.
Single Numbers, 50 Cents.

Persons who desire the Magazine from the beginning, can be supplied with Vols. I to VII, inclusive, neatly bound in cloth, for $20.00; half Turkey morocco, $30.00.

D. VAN NOSTRAND, PUBLISHER,

23 MURRAY ST. & 27 WARREN ST., NEW YORK.

*** Copies of the above Books sent free by mail on receipt of price, and New Catalogue of Scientific Books sent to any address on application.

Hosted by Google

Water Gauges.

J. G. Knapp Manufacturing Co.....New York.....See Page 16
J. J. Walworth..... Chicago, Ill..... " 124
McNab & Harlin Manufacturing Co .....New York..... " 220
Pancoast & Maule.....Philadelphia, Pa..... " 26

Water Pipe.

J. T. Ryerson.....Chicago, Ill..... " 180
Morris, Tasker Co.....Philadelphia, Pa..... " 36
R. A. Brick & Co..... .....New York..... " 48

Wedges.

Hermann Boker & Co.....New York.....See Pages 152, 154

Wheelbarrows.

Geo. Worthington & Co.....Cleveland, Ohio .....See Page 100
T. B. Bickerton & Co..... .....Philadelphia, Pa..... " 138

Wheel Presses.

Isaac H. Shearman..... .....Philadelphia, Pa.....See Page 80
Wm. B. Bement & Son..... ..... " " ..... " 168

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
661	436921	288804781	25.709	8.710	691	477481	329939371	26.286	8.840
662	438244	290117528	25.729	8.715	692	478864	331373888	26.305	8.845
663	439569	291434247	25.748	8.719	693	480249	332812557	26.324	8.849
664	440896	292754944	25.768	8.724	694	481636	334255384	26.343	8.853
665	442225	294079625	25.787	8.728	695	483025	335702375	26.362	8.857
666	443556	295408296	25.806	8.732	696	484416	337153536	26.381	8.862
667	444889	296740963	25.826	8.737	697	485809	338608873	26.400	8.866
668	446224	298077632	25.845	8.741	698	487204	340068397	26.419	8.870
669	447561	299418309	25.865	8.745	699	488601	341532099	26.438	8.874
670	448900	300763000	25.884	8.750	700	490000	343000000	26.457	8.879
671	450241	302111711	25.903	8.754	701	491401	344472101	26.476	8.883
672	451584	303464448	25.922	8.759	702	492804	345948408	26.495	8.887
673	452929	304821217	25.942	8.763	703	494209	347428927	26.514	8.891
674	454276	306182024	25.961	8.767	704	495616	348913664	26.533	8.895
675	455625	307546875	25.980	8.772	705	497025	350402625	26.551	8.900
676	456976	308915776	26.0	8.776	706	498436	351895816	26.570	8.904
677	458329	310288733	26.019	8.780	707	499849	353393243	26.389	8.908
678	459684	311665752	26.038	8.785	708	501264	354894917	26.608	8.912
679	461041	313046839	26.057	8.789	709	502681	356400829	26.627	8.916
680	462400	314432000	26.076	8.793	710	504100	357911000	26.645	8.921
681	463761	315821241	26.095	8.797	711	505521	359425431	26.664	8.925
682	465124	317214568	26.115	8.802	712	506944	360944128	26.683	8.929
683	466489	318611987	26.134	8.806	713	508369	362467097	26.702	8.933
684	467856	320013504	26.153	8.810	714	509796	363994344	26.720	8.937
685	469225	321419125	26.172	8.815	715	511225	365525875	26.739	8.942
686	470596	322828856	26.191	8.819	716	512656	367061696	26.758	8.946
687	471969	324242703	26.210	8.823	717	514089	368601813	26.776	8.950
688	473344	325660672	26.229	8.828	718	515524	370146232	26.795	8.954
689	474721	327082769	26.248	8.832	719	516961	371694959	26.814	8.958
690	476100	328509000	26.267	8.836	720	518400	373248000	26.832	8.962

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Rainapo Wheel and Foundry Co.

Hosted by Google

TYNG & COMPANY,

IMPORTERS AND MERCHANTS IN

IRON, STEEL AND METALS.

No. 98 William St., NEW YORK.

61 South Canal St., CHICAGO.

BAR, PLATE and SHEET IRON,
GALVANIZED SHEET IRON,
TIN PLATES and METALS.

SOLE AGENTS FOR

HOWELL & COMPANY'S SHEFFIELD
EXTRA CAST STEEL AND FILES.

IMPORTERS OF

LAP WELDED IRON FLUES, TORPEDO FOG SIGNALS,
SALTER'S LOCOMOTIVE BALANCES, &c., &c.

NEW YORK RUBBER COMPANY,

[INCORPORATED 1851.]

MANUFACTURERS OF

STANDARD RUBBER GOODS,

FOR RAILROAD PURPOSES,

COMPRISING

CAR SPRINGS, PACKING,
HOSE and BELTING.

These Goods are to be had of our Agents in all the principal Cities of the Union, and at our WAREHOUSE,

NOS. 5 & 7 DEY ST., NEW YORK.

☞ **Address P. O. Box 1160.**

Hosted by Google

Wheel Borers.

Isaac H. Shearman ....Philadelphia, Pa.....See Page 80

BELTING.

(*Hamilton.*)

Horse-power of a belt equals velocity in feet per minute, multiplied by the width—the sum divided by 1000.

One inch single belt, moving at 1000 feet per minute = 1 horse-power.

Double belts about 700 feet per minute, per 1 inch width = 1 horse-power.

For double belts of great length, over large pulleys, allow about 500 feet per minute per 1 inch of width per horse-power.

Power should be communicated through the lower running side of a belt; the the upper side to carry the slack.

Average breaking weights of a belt, $\frac{3}{16} \times 1$ inch wide.

Leather, 530 lbs.: 3-ply rubber, 600 lbs.

The strength of a belt increases directly as its width. The co-efficient of safety for a laced belt is— Leather = $\frac{1}{16}$ breaking weight.
Rubber = $\frac{1}{8}$ " "

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
721	519841	374805361	26.851	8.966	751	564001	423564751	27.404	9.089
722	521284	376367048	26.870	8.971	752	565504	425259008	27.422	9.093
723	522729	377933067	26.888	8.975	753	567009	426957777	27.440	9.097
724	524176	379503424	26.907	8.979	754	568516	428661064	27.459	9.101
725	525625	381078125	26.925	8.983	755	570025	430368875	27.477	9.105
726	527076	382657176	26.944	8.987	756	571536	432081216	27.495	9.109
727	528529	384240583	26.962	8.991	757	573049	433798093	27.513	9.113
728	529984	385828352	26.981	8.995	758	574564	435519512	27.531	9.117
729	531441	387420489	27.0	9.0	759	576081	437245479	27.549	9.121
730	532900	389017000	27.018	9 004	760	577600	438976000	27.568	9.125
731	534361	390617891	27.037	9.008	761	579121	440711081	27.586	9.129
732	535824	392223168	27.055	9.012	762	580644	442450728	27.604	9.133
733	537289	393832837	27.073	9.016	763	582169	444194947	27.622	9.137
734	538756	395446904	27.092	9.020	764	583696	445943744	27.640	9.141
735	540225	397065375	27.110	9.024	765	585225	447697125	27.658	9.145
736	541696	398688256	27.129	9.028	766	586756	449455096	27.676	9.149
737	543169	400315553	27.147	9.032	767	588289	451217663	27.694	9.153
738	544644	401947272	27.166	9.036	768	589824	452984832	27.712	9.157
739	546121	403583419	27.184	9.040	769	591361	454756609	27.730	9.161
740	547600	405224000	27.202	9.045	770	592900	456533000	27.748	9.165
741	549081	406869021	27.221	9.049	771	594441	458314011	27.766	9.169
742	550564	408518488	27.239	9.053	772	595984	460099648	27.784	9.173
743	552049	410172407	27.258	9.057	773	597529	461889917	27.802	9.177
744	553536	411830784	27.276	9.061	774	599076	463684824	27.820	9.181
745	555025	413493625	27.294	9.065	775	600625	465484375	27.838	9.185
746	556516	415160936	27.313	9.069	776	602176	467288576	27.856	9.189
747	558009	416832723	27.331	9.073	777	603729	469097433	27.874	9.193
748	559504	418508992	27.349	9.077	778	605284	470910952	27.892	9.197
749	561001	420189749	27.367	9.081	779	606841	472729139	27.910	9.201
750	562500	421875000	27.386	9.085	780	608400	474552000	27.928	9.205

Continued on Page 265

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

O. W. CHILD,

22 PINE ST., NEW YORK.

Railroad Iron and Supplies,

American and English Iron and Steel Rails,

FREIGHT CARS, viz.

BOX, FLATS, GONDOLAS, COAL, HAY and STOCK.

PASSENGER CARS, LOCOMOTIVES,

FISH PLATES, SPIKES, BOLTS and NUTS,

FROGS and SWITCHES, TURN-TABLES, &c.

OLD RAILS BOUGHT AND SOLD.

Railroad Bonds and Securities Negotiated.

CHARLES F. KETCHAM,

PRINTER, STATIONER, LITHOGARPHER,

AND BLANK BOOK MANUFACTURER,

Nos. 27 & 29 Nassau Street, New York.

RAILROAD PRINTING A SPECIALTY.

Orders for every kind of BLANK FORMS AND BOOKS required by Railroad or Transportation Companies, executed in the neatest style, and with the utmost economy and promptness.

My long experience in this branch of the business, renders me familiar with the wants of this class of customers, and the accumulation of Forms and Copies is of great and mutual advantage, and especially so to parties desiring to make CHANGES IN THEIR FORMS or about procuring OUTFITS FOR NEW ROADS.

WAY BILLS, VOUCHERS, REPORTS AND BLANKS of any kind, of which impressions are to be taken with the Copying Press, Printed and ruled in Copying Ink.

LITHOGRAPHIC WORK, comprising Bonds, Certificates of Stock, Drafts, Checks, Time Charts, Passes, Letter and Note Headings, Maps, &c., executed in the best style and on the most favorable terms.

ENGINEERS' MATERIALS manufactured, imported and kept on hand in great variety.

BLANK BOOKS of any desired pattern or quantity made to order.

A full line of Staple and Fancy **STATIONERY** constantly on hand and for sale at the lowest market rates.

SAMPLES AND ESTIMATES FURNISHED ON APPLICATION.

Hosted by Google

Wheels.

Bowlers, Maher & Brayton.....Cleveland, Ohio.....See Page 42
Davenport, Fairbairn & Co.....Erie, Pa..... " 188
Greene & Randolph.....New York..... " 54
Jonas S. Heartt & Co.....Troy, N. Y..... " 134
Ramapo Wheel & Foundry Co.....Ramapo, N. Y..... " 256
Wason Manufacturing Co.....Springfield, Mass..... " 146

Whistles—Steam.

See Steam Whistles.

White Lead.

Atlantic White Lead Co.—Rob't Colgate & Co. New York.....See Pages 238, 240
Brooklyn White Lead Co..... " " ..... " 268
C. E. Hecht.....Easton. Pa..... " 158
F. S. Pease.....Buffalo, N. Y..... " 100
Jno. Jewett & Son.....New York.....See Pages 72, 74
Jno. W. Masury & Son..... " " .....See Page 214
T. B. Bickerton & Co.....Philadelphia, Pa..... " 138
Wetherill & Bro..... " " ..... " 52
Wm. Green & Co.....Wilmington, Del..... " 248

TONS OF RAILS, JOINTS, ETC., TO ONE MILE SINGLE TRACK.

(*Furnished by O. W. Child, 22 Pine St., New York.*)

Tons of Rails Required per Mile of Single Track.

	Tons.	lbs.		Tons.	lbs.
Weight 12 lbs. per yard.....	18	1920	Weight 50 lbs. per yard.....	78	1280
" 16 " "	25	320	" 56 " "	88	
" 20 " "	31	960	" 60 " "	94	640
" 25 " "	39	640	" 65 " "	102	320
" 30 " "	47	320	" 70 " "	110	
" 35 " "	55		" 75 " "	117	920
" 40 " "	62	1920	" 80 " "	125	1600
" 45 " "	70	1600			

Number of Fish Joints per Mile.

24 feet Rails.....	440 Joints.	28 feet Rails.....	378 Joints.
26 " "	406 "	30 " "	352 "

Ordinary number of Ties per Mile..... 2640.
Ordinary Quantity of Spikes, $5\frac{1}{2} \times \frac{9}{16}$ inch per mile..... 5500 lbs.

CULVERTS FOR RAILWAYS.

(*Molesworth*)

	Diameter.		Thickness of Arch.		Thickness of Invert.		Thickness of Sides.		Clear Height Inside.		Cube Yards in 1 Lineal Yard of Culvert.
	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	
Brickwork.....	1	6	0	9	Barrel.						0.60
	2	0	0	9	Barrel.						0.75
	3	0	0	9	0	9	1	2	3	3	1.60
	4	0	1	2	0	9	1	6	4	6	3.30
	5	0	1	2	0	9	1	10	5	6	4.70
	6	0	1	6	0	9	2	3	6	6	6.10
Rubble masonry with hammer-dressed arches.	flat top 1	6	0	6	1	0	1	6	2	6	1.50
	2	0	0	9	1	0	2	0	3	0	2.00
	3	0	1	0	0	9	2	6	3	3	4.00
	5	0	1	0	1	0	3	0	5	6	6.70
	6	0	1	4	1	0	3	6	5	6	7.60

Hosted by Google

The Frazer Railroad Lubricator,

THE BEST AND CHEAPEST LUBRICATOR FOR RAILROADS IN USE.

Superintendents, Purchasing Agents and Master Mechanics are invited to GIVE IT A TRIAL.

QUALITY ALWAYS ALIKE, AND NOT AFFECTED BY CLIMATE.

OFFICES:

104 MAIDEN LANE, **NEW YORK.**

134 E. KINZIE ST., **CHICAGO, ILL.**

CAMPBELL & THAYER,

89 MAIDEN LANE, NEW YORK,

MANUFACTURERS OF

LINSEED OIL,

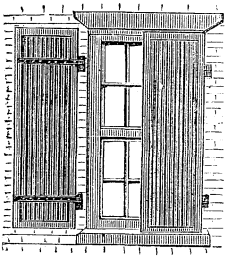
Raw, Refined and Boiled, in Casks and Barrels.

ALSO

LINSEED CAKE.

NOYES & WINES,

CORRUGATED IRON CO.



44 CENTRE ST., NEW YORK,

MANUFACTURERS OF THE

Patent Metallic Clap-Board

AND

CORRUGATED IORN.

IRON CORNICES, MOULDINGS, &c.

Iron Arches for Fire-Proof Buildings, Iron Shutters, Doors, &c.

Hosted by Google

White Brass.

Du Plaine & Reeves.....Philadelphia, Pa.....See Page 102

White Zinc.

C. E. Hecht.....Easton, Pa.....See Page 158
Jno. W. Masury & Son.....New York..... " 214

Window Glass.

D. R. Hobart & Co.....New York.....See Page 126
Leffingwell & Co.....Cleveland, Ohio..... " 190
Vose, Dinsmore & Co.....New York..... " 60

Wire.

Ansonia Brass & Copper Co.....New York.....See Page 122
Atwater, Wheeler & Co.....New Haven, Conn..... " 10
Bruce & Cook.....New York..... " 112
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
Jno. Merry & Co.....New York..... " 48
Marshall Lefferts, Jr..... " " ..... " 44

To find Length of Belting, when Closely Rolled.

The sum of the diameters of the roll and the eye in inches, multiplied by the number of turns made by the belt, and this product multiplied by the decimal .1309, will equal length of the belt in feet.—*Auchinchloss.*

Squares, Cubes, Square Roots, and Cube Roots—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
781	609961	476379541	27.946	9.209	811	657721	533411731	28.478	9.325
782	611524	478211768	27.964	9.213	812	659344	535387328	28.495	9.329
783	613089	480048687	27.982	9.216	813	660969	537367797	28.513	9.333
784	614656	481890304	28.0	9.220	814	662596	539353144	28.530	9.337
785	616225	483736625	28.017	9.224	815	664225	541343375	28.548	9.340
786	617796	485587656	28.035	9.228	816	665856	543338496	28.565	9.344
787	619369	487443403	28.053	9.232	817	667489	545338513	28.583	9.348
788	620944	489303872	28.071	9.236	818	669124	547343432	28.600	9.352
789	622521	491169069	28.089	9.240	819	670761	549353259	28.618	9.356
790	624100	493039000	28.106	9.244	820	672400	551368000	28.635	9.359
791	625681	494913671	28.124	9.248	821	674041	553387661	28.653	9.363
792	627264	496793088	28.142	9.252	822	675684	555412248	28.670	9.367
793	628849	498677257	28.160	9.256	823	677329	557441767	28.687	9.371
794	630436	500566184	28.178	9.259	824	678976	559476224	28.705	9.375
795	632025	502459875	28.195	9.263	825	680625	561515625	28.722	9.378
796	633616	504358336	28.213	9.267	826	682276	563559976	28.740	9.382
797	635209	506261573	28.231	9.271	827	683929	565609283	28.757	9.386
798	636804	508169592	28.248	9.275	828	685584	567663552	28.774	9 390
799	638401	510082399	28.266	9.279	829	687241	569722789	28.792	9.394
800	640000	512000000	28.284	9.283	830	688900	571787000	28.809	9.397
801	641601	513922401	28.301	9.287	831	690561	573856191	28.827	9.401
802	643204	515849608	28.319	9.290	832	692224	575930368	28.844	9.405
803	644809	517781627	28.337	9.294	833	693889	578009537	28.861	9.409
804	646416	519718464	28.354	9.298	834	695556	580093704	28.879	9.412
805	648025	521660125	28.372	9.302	835	697225	582182875	28.896	9.416
806	649636	523606616	28.390	9.306	836	698896	584277056	28.913	9.420
807	651249	525557943	28.407	9.310	837	700569	586376253	28.930	9.424
808	652864	527514112	28.425	9.314	838	702244	588480472	28.948	9.427
809	654481	529475129	28.442	9.317	839	703921	590589719	28.965	9.431
810	656100	531441000	28.460	9.321	840	705600	592704000	28.982	9.435

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. Van Nostrand,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

WM. B. BROWNE. H. DAWES SMITH. J. MACBETH

WM. B. BROWNE & CO.

Signal, Binnacle, Machinery, Lard, Sperm, Railroad Car Axle, West Virginia,

Locomotive Head Light Engine, Tallow, Kerosene, Cylinder, Neatsfoot, Olive, Whale.

TRADE MARK.

OIL MANUFACTURERS,

128 MAIDEN LANE, NEW YORK.

POSTS & KALKMAN,

113 LIBERTY ST., NEW YORK,

MANUFACTURERS OF

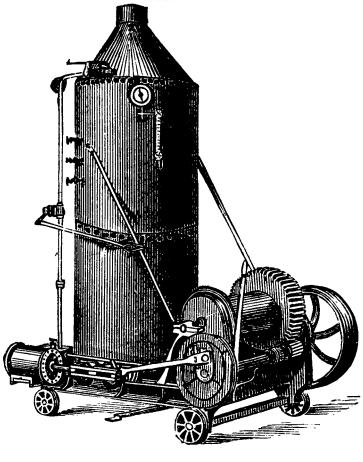
PRESCOTT'S & KALKMAN'S PATENT SAFETY POP VALVE,

DENISON'S PATENT COOLING and LUBRICATING COMPOUND

And GRAHAM'S CAR-DOOR CATCHES.

RAILROAD AND MACHINISTS' SUPPLIES.

C. J. POST. W. B. POST. C. W. KALKMAN.



J. S. MUNDY,

7 Railroad Ave., Newark, N. J.

MANUFACTURER OF

HOISTING, PUMPING AND MINING ENGINES,

From 5 to 40 Horse Power, Double and Single. 8 and 12 Horse Power Constantly on Hand.

Hoisting Machinery,

Stationary and Dummy Engines, Shafting, Pulleys and Hangers.

☞ Machinery of all kinds Improved and Repaired. Work Done in the Best Manner and Warranted.

Hosted by Google

Wire Brushes

Van Tuyl Manufacturing Co.....New York.....See Page 242

Wire Cloth.

Radley & McAlister Manufacturing Co.....New York.....See Page 250

Wire Cutters.

Biddle Manufacturing Co.....New York.....See Page 12

Wire Rope.

De Grauw, Aymar & Co.....New York.....See Page 112
Speedwell Iron Works..... " " ..... " 122

Wood Manteis.

Joseph Churchyard.....Buffalo, N. Y.....See Page 160

Wood Mouldings.

Joseph Churchyard.....Buffalo, N. Y.....See Page 160

Wood Ornaments.

Vose, Dinsmore & Co.....New York.....See Page 60

Wood Screws.

Hoopes & Townsend.....Philadelphia, Pa.....See Page 28
Wm. Gilmor of Wm.....Baltimore, Md..... " 248

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
841	707281	594823321	29.0	9.439	871	758641	660776311	29.512	9.550
842	708964	596947688	29.017	9.442	872	760384	663054848	29.529	9 553
843	710649	599077107	29.034	9.446	873	762129	665338617	29.546	9.557
844	712336	601211584	29.051	9.450	874	763876	667627624	29.563	9.561
845	714025	603351125	29.068	9.454	875	765625	669921875	29.580	9.564
846	715716	605495736	29.086	9.457	876	767376	672221376	29.597	9.568
847	717409	607645423	29.103	9.461	877	769129	674526133	29.614	9.571
848	719104	609800192	29.120	9.465	878	770884	676836152	29.631	9.575
849	720801	611960049	29.137	9.468	879	772641	679151439	29.647	9.579
850	722500	614125000	29.154	9.472	880	774400	681472000	29.664	9.582
851	724201	616295051	29.171	9.476	881	776161	683797841	29.681	9.586
852	725904	618470208	29.189	9.480	882	777924	686128968	29.698	9.590
853	727609	620650477	29.206	9.483	883	779689	688465387	29.715	9.593
854	729316	622835864	29.223	9.487	884	781456	690807104	29.732	9.597
855	731025	625026375	29.240	9.491	885	783225	693154125	29.748	9.600
856	732736	627222016	29.257	9.494	886	784996	695506456	29.765	9.604
857	734449	629422793	29.274	9.498	887	786769	697864103	29.782	9.608
858	736164	631628712	29.291	9.502	888	788544	700227072	29.799	9.611
859	737881	633839779	29.308	9.506	889	790321	702595369	29.816	9.615
860	739600	636056000	29.325	9.509	890	792100	704969000	29 832	9.619
861	741321	638277381	29.342	9 513	891	793881	707347971	29.849	9.622
862	743044	640503928	29.359	9.517	892	795664	709732288	29.866	9.626
863	744769	642735647	29.376	9.520	893	797449	712121957	29.883	9.629
864	746496	644972544	29.393	9 524	894	799236	714516984	29.899	9.633
865	748225	647214625	29.410	9.528	895	801025	716917375	29.916	9.636
866	749956	649461896	29.427	9.531	896	802816	719323136	29.933	9.640
867	751689	651714363	29.444	9.535	897	804609	721734273	29.949	9.644
868	753424	653972032	29.461	9.539	898	806404	724150792	29.966	9.647
869	755161	656234909	29.478	9.542	899	808201	726572699	29.983	9.651
870	756900	658503000	29.495	9.546	900	810000	729000000	30.0	9.654

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND.
For the Ramapo Wheel and Foundry Co.

Hosted by Google

BROOKLYN WHITE LEAD CO

(INCORPORATED 1825.)

CORRODERS and MANUFACTURERS

OF

PERFECTLY PURE WHITE LEAD.

BEWARE OF SPURIOUS LEADS PUT UP IN IMITATION OF THE BRANDS OF THIS COMPANY.

☞ Every Keg sent out by us is labeled with our *COPYRIGHT TRADE MARK* on *BLUE PAPER,* and is GUARANTEED to be perfectly pure.

TRADE MARK.

Pure Dry Lead and Litharge,

FOR POTTERS' and INDIA RUBBER MANUFACTURERS' USE.

Office, 89 Maiden Lane, New York.

Hosted by Google

Wood-Working Machinery.

Buffalo Machinery Agency.....Buffalo, N. Y.....See Page 160
C. B. Rogers & Co.....New York..... " 210
J. A. Fay & Co.....Cincinnati, Ohio..... " 206
J. T. & R. H. Plass.....New York..... " 208
Phelps & Sanger.....Cleveland, Ohio..... " 120
Richards, London & Kelley.....Philadelphia, Pa..... " 66

Woolen Waste.

T. B. Bickerton & Co.....Philadelphia, Pa.....See Page 138

Wrecking Derricks.

Skinner & Gifford Manufacturing Co.....Dunkirk, N. Y.....See Page 140

Wrecking Pumps.

Charles B. Hardick.....Brooklyn, N. Y.....See Page 84

Wrenches.

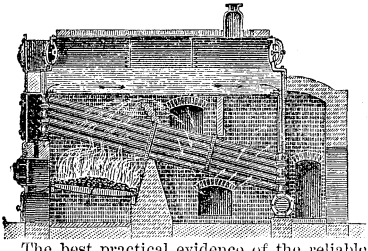
Barwick Wrench Co.....Boston, Mass.....See Page 60
Champlin & Rogers.....Chicago, Ill..... " 192
Geo. Worthington & Co.....Cleveland, Ohio..... " 100
J. J. Walworth.....Chicago, Ill..... " 124
L. G. Tillotson & Co.....New York..... " 94
Pratt & Co.....Buffalo, N. Y..... " 132

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
901	811801	731432701	30.016	9.658	931	866761	806954491	30.512	9.764
902	813604	733870808	30.033	9.662	932	868624	809557568	30 528	9.767
903	815409	736314327	30.049	9.665	933	870489	812166237	30.545	9.771
904	817216	738763264	30.066	9.669	934	872356	814780504	30.561	9.774
905	819025	741217625	30 083	9.672	935	874225	817400375	30.577	9.778
906	820836	743677416	30.099	9.676	936	876096	820025856	30.594	9.781
907	822649	746142643	30.116	9.679	937	877969	822656953	30.610	9.785
908	824464	748613312	30.133	9.683	938	879844	825293672	30.626	9.788
909	826281	751089429	30.149	9.686	939	881721	827936019	30.643	9.792
910	828100	753571000	30.166	9.690	940	883600	830584000	30.659	9.795
911	829921	756058031	30.182	9.694	941	885481	833237621	30.675	9.799
912	831744	758550528	30.199	9.697	942	887364	835896888	30.692	9.802
913	833569	761048497	30.215	9.701	943	889249	838561807	30.708	9.806
914	835396	763551944	30.232	9.704	944	891136	841232384	30.724	9.809
915	837225	766060875	30.248	9.708	945	893025	843908625	30.740	9.813
916	839056	768575296	30.265	9.711	946	894916	846590536	30.757	9.816
917	840889	771095213	30.282	9.715	947	896809	849278123	30.773	9.820
918	842724	773620632	30.298	9.718	948	898704	851971392	30.789	9.823
919	844561	776151559	30.315	9.722	949	900601	854670349	30.805	9.827
920	846400	778688000	30.331	9.725	950	902500	857375000	30.822	9.830
921	848241	781229961	30.347	9.729	951	904401	860085351	30.838	9.833
922	850084	783777448	30.364	9.732	952	906304	862801408	30.854	9.837
923	851929	786330467	30.380	9.736	953	908209	865523177	30.870	9.840
924	853776	788889024	30.397	9.739	954	910116	868250664	30.886	9.844
925	855625	791453125	30.413	9.743	955	912025	870983875	30.903	9.847
926	857476	794022776	30.430	9.746	956	913936	873722816	30.919	9.851
927	859329	796597983	30.446	9.750	957	915849	876467493	30.935	9.854
928	861184	799178752	30.463	9.754	958	917764	879217912	30.951	9.857
929	863041	801765089	30.479	9.757	959	919681	881974079	30.967	9.861
930	864900	804357000	30.495	9.761	960	921600	884736000	30.983	9.864

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google



BABCOCK & WILCOX'S

TUBULOUS

SAFETY BOILER.

The best practical evidence of the reliable character of this Boiler is found in the following partial list of our customers:

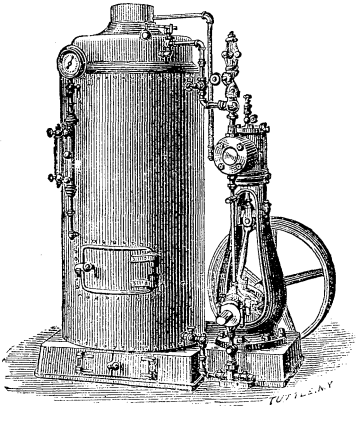
THE SINGER MANF'G CO., Sewing Machines,	New York,	5	orders,	1560 H.P.
HAVEMEYER & ELDER, Sugar Refiners,	"	2	"	600 "
DECASTRO & DONNER, Sugar Refining Co.,	"	2	"	900 "
F. O. MATTHIESSEN & WIECHERS, Sugar Ref. Co.	"			300 "
HAVEMEYER BROS. & CO., Sugar Refiners,	"	2	"	450 "
HARRISON, HAVEMEYER & CO., Sugar Refiners,	Philadelphia, Pa.			600 "
WAHL BROTHERS, Glue Manufacturers, Chicago, Ill.,		2	"	300 "
STUDEBAKER BROS'. WAGON CO., South Bend, Ind.				300 "
BELCHER SUGAR REFINING CO., St. Louis, Mo.				300 "
DAVID TRAINOR & SON, Cotton Mills, Linwood, Pa.		3	"	425 "
JESSUP & MOORE, Paper Manufacturers, Wilmington, Del.				200 "
WM. E. HOOPER & SONS, Cotton Mills, Baltimore, Md.		2	"	325 "
GAMBRILL, SONS & CO., " "	"			150 "
CALVERT SUGAR REFINERY,	"	5	"	1100 "
WOODS, WEEKS & CO., Sugar Refiners,	"	3	"	750 "

And others in all parts of the country. Also all sizes of *Vertical and Horizontal Steam Engines.* ☞ Illustrated Circulars and information sent on application.

BABCOCK & WILCOX, 30 Cortlandt St., N. Y.

New York Safety Steam Power Co.

30 CORTLANDT ST., NEW YORK.



SUPERIOR

Steam Engines and Boilers,

by special machinery and duplication of parts. They are

SAFE,
ECONOMICAL,
EASILY MANAGED,

and not liable to derangement. Their

Combined Engine and Boiler

is peculiarly adapted to all purposes requiring small power. More than 400 Engines, from 2 to 100 horse-power, in use.

☞ *Send for Illustrated Circular.*

Hosted by Google

Wrought Iron Beams.

Rogers & Co.....Chicago, Ill.....See Page 144
Vose, Dinsmore & Co.....New York..... " 60

Wrought Iron Hardware.

D. Brewer & Co.....Philadelphia, Pa.....See Page 246

Wrought Iron Pipe.

Crane Bros. Manufacturing Co.....Chicago, Ill.....See Page 230
Evans, Dalzell & Co.....Pittsburgh, Pa..... " 58
Hart, Ball & Hart.....Buffalo, N. Y..... " 136
Morris, Tasker & Co.....Philadelphia, Pa..... " 36
Pancoast & Maule..... " " ..... " 26
Tyng & Co.....New York..... " 260
Wm. Graff & Co.....Pittsburgh, Pa..... " 174

Wrought Iron Tubes.

Morris, Tasker & Co.....Philadelphia, Pa.....See Page 36

Zinc.

Bruce & Cook.....New York.....See Page 112
Jay & Cook..... " " ..... " 234
Jno. W. Quincy..... " " ..... " 176
Sidney Shepard & Co.....Buffalo, N. Y..... " 196

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS—*Continued.*

No.	Square.	Cube.	Square Root.	Cube Root.	No.	Square.	Cube.	Square Root.	Cube Root.
961	923521	887503681	31.0	9.868	981	962361	944076141	31.320	9.936
962	925444	890277128	31.016	9.871	982	964324	946966168	31.336	9.939
963	927369	893056347	31.032	9.875	983	966289	949862087	31.352	9.943
964	929296	895841344	31.048	9.878	984	968256	952763904	31.368	9.946
965	931225	898632125	31.064	9.881	985	970225	955671625	31.384	9.949
966	933156	901428696	31.080	9.885	986	972196	958585256	31.400	9.953
967	935089	904231063	31.096	9.888	987	974169	961504803	31.416	9.956
968	937024	907039232	31.112	9.892	988	976144	964430272	31.432	9.959
969	938961	909853209	31.128	9.895	989	978121	967361669	31.448	9.963
970	940900	912673000	31.144	9.898	990	980100	970299000	31.464	9.966
971	942841	915498611	31.160	9.902	991	982081	973242271	31.480	9.969
972	944784	918330048	31.176	9.905	992	984064	976191488	31.496	9.973
973	946729	921167317	31.192	9.909	993	986049	979146657	31.511	9.976
974	948676	924010424	31.208	9.912	994	988036	982107784	31.527	9.979
975	950625	926859375	31.225	9.915	995	990025	985074875	31.543	9.983
976	952576	929714176	31.241	9.919	996	992016	988047936	31.559	9.986
977	954529	932574833	31.257	9.922	997	994009	991026973	31.575	9.989
978	956484	935441352	31.272	9.926	998	996004	994011992	31.591	9.993
979	958441	938313739	31.288	9.929	999	998001	997002999	31.606	9.996
980	960400	941192000	31.304	9.932	1000	1000000	1000000000	31.622	10.0

THIS TABLE IS TAKEN FROM
"Hamilton's Useful Information for Railway Men,"
Published by D. VAN NOSTRAND,
For the Ramapo Wheel and Foundry Co.

Hosted by Google

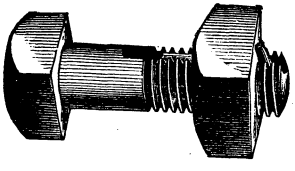
WM. COURTENAY,
President.

CHARLES F. COBB
Secretary.

THE LOCK-NUT AND BOLT CO.

OF NEW YORK.

Office, No. 61 Broadway.



CUMMING NUT-LOCK

PATENTED

JUNE 16, 1868, and AUGUST 23, 1870.

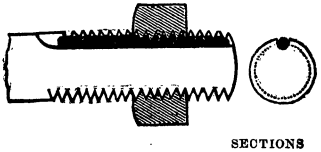
THE ONLY

Cheap, Simple, Effective,

AND

ADJUSTABLE LOCK-NUT BOLT,

THAT HAS NEVER FAILED.



SECTIONS

Having enlarged our works, we can now turn out

20,000 Fish-Plate Bolts and 10,000 Car and Machine Bolts per Day,

all made of the best PUDDLED IRON, manufactured by ourselves.

NO SCRAP IRON USED IN BOLTS.

☞ Our Fish-Plate Joints, with Lock-Nut Bolts, are now in use on over FIFTY RAILROADS, with complete success, and are pronounced *the Only Secure Joint.*

WE ALSO MANUFACTURE

FISH PLATES OF ANY PATTERN.

SPIKES OF ALL SIZES.

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

Hosted by Google

GUNPOWDER.

Laflin & Rand Powder Co.

21 PARK ROW,

NEW YORK.

Orange Rifle Powder,
Orange Ducking Powder,
Orange Lightning Powder,
Audubon Powder

All UNIFORM, STRONG and CLEANER THAN any OTHER BRANDS

MINING and BLASTING POWDER

IN EVERY VARIETY.

SAFETY FUSE OF ALL KINDS,

ELECTRICAL BLASTING APPARATUS, &c.

Agencies and Magazines at all Prominent Points.

Hosted by Google